

Sept 2002

Missionary Ridge Complex

Durango, Colorado

June - July 2002

Burned Area Emergency Stabilization and Rehabilitation Plan



USDA Forest Service • USDI Bureau of Land Management
• U.S. Geological Survey



Prepared by:
**Burned Area Emergency
Response Team**
July 2002



Missionary Ridge Complex

BURNED AREA EMERGENCY STABILIZATION AND REHABILITATION PLAN

AGENCY/UNIT: U.S. Forest Service
San Juan National Forest
Columbine Ranger District

LOCATION: Durango, Colorado

DATE: July 12, 2002

PREPARED BY: Burned Area Emergency Response (BAER) Team



Submitted By:

Monte Williams

Monte Williams, USDA, Forest Service

Date:

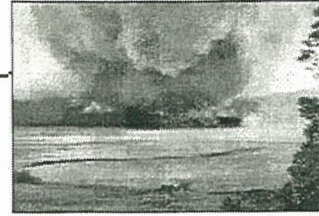
7/15/02



EXECUTIVE SUMMARY

Introduction

This plan has been prepared in accordance with the *Interagency Policy Guidance and Direction: Forest Service Manual 2523, Burned Area Emergency Rehabilitation and Interagency Burned Area Emergency Stabilization and Rehabilitation Handbook (2001)*. The plan provides emergency fire stabilization and rehabilitation recommendations for all lands burned within the Missionary Ridge Complex including public lands of the US Forest Service, and Bureau of Land Management. The primary objectives of the Missionary Ridge Complex Burned Area Emergency Stabilization and Rehabilitation Plan are:



- Assess the effects of the Missionary Ridge Fire and estimate the effect to downstream *values* at risk.
- To prescribe post-fire mitigation measures necessary to protect human life, property, and critical cultural and natural resources.

BAER team members conducted an analysis of fire effects throughout the lands impacted by the fire. The watershed group assessed the overall watershed changes from the fire and developed a burn severity map. Archeologists inventoried suppression impacts for potential damage to cultural sites as well as initiating a cultural resource damage assessment. The BAER team forester assessed potential areas for reforestation and salvage. The vegetation specialists evaluated and assessed fire effects and suppression impacts to vegetation resources, identified values at risk associated with vegetation losses, and worked with the watershed group and resource specialists to identify seeding requirements and seed mix. The wildlife biologist conducted an assessment of threatened and endangered species and initiated Section 7 consultation with the U.S. Fish & Wildlife Service. GIS specialists gathered the data layers necessary for the plan, coordinated GPS activities, and transmitted the data to the jurisdictions with GIS capability. The operations specialists coordinated with teams *from* the San Juan National Forest.

Fire Background

The Missionary Ridge Complex is located near Durango, Colorado. Federal lands within the burned areas are administered by the U.S. Forest Service and Bureau of Land Management. Private and State of Colorado lands were also involved. Cooperating agencies also included the Southern Ute Tribe, and La Plata County Office of the Emergency Management. Total costs for the Complex through July 13th were estimated at \$39,800,000.

The BAER Team, tasked with evaluation of short- and long-term rehabilitation needs, developed this plan to address the following issues:

- ☐ Residences, facilities, and structures within the areas of potential post fire flooding
- ☐ Facilities or improvements impacted by the fire or the suppression of the fire
- ☐ Cultural and natural resource values impacted by the fire or fire suppression actions
- ☐ Rehabilitation requirements established by federal law, policies, and relevant Bureau of Land Management and US Forest Service resource management plan mandates
- ☐ Rehabilitation requirements established by state laws, policies, and regulations
- ☐ Implementation of treatments in a timely manner



Resource Damages and Threats to Human Safety and Resources

The complex included the Missionary Ridge fire (72,962 acres), and the Valley Fire (429 acres). Fire severity mapping conducted on the Missionary Ridge Complex classified 31% of the burn as high burn severity, 30% as moderate burn severity, and 39% as unburned or low burn severity.

The primary watershed responses of the Missionary Ridge and the Valley fires are expected to include an initial flush of ash, some gully and rill erosion in drainages and on the steep slopes within the burned area, debris and sediment transport, and scouring and deposition in valleys. Post-fire peak flows from the burned area are expected to increase substantially. Release of sediment from high to moderate burn severity areas could place humans, animals, and resources at risk in the lower portions of drainages and below steep slopes. Values at risk include residences, structures, roads, and culverts located in the lower portions of the drainages.

The BAER Team conducted **intensive field surveys** after the fire to identify impacts and compile the following recommendations for stabilization and rehabilitation of affected lands:

Stabilization and Rehabilitation

The plan calls for the following actions:

- ☐ Aerial seeding on approximately 15,000 acres
- ☐ **Log erosion barriers** on approximately 7300 acres
- ☐ Straw mulch on approximately 300 acres
- ☐ Precipitation and early flow warning systems
- ☐ Engineering design of stream diversion at Lemon Dam spillway
- ☐ Engineering assessment and **design** to stabilize slumps in drainages
- ☐ **Debris jam monitoring** after rainfall events
- ☐ **Treatment effectiveness monitoring**
- ☐ Numerous road and trail specifications, including culvert replacement, culvert installation, grade dip construction, ditch cleaning, sign replacement, and trail assessment and repair
- ☐ **Hazard tree removal** along roads, trails, campgrounds, and near some private land boundaries.

Tree hazards were inventoried around burned structures, roads, and work sites, and most of the trees **have been** dropped. An inventory of forest mortality and potential reforestation needs was also conducted.

Early in the assessment process, BAER team hydrologists recognized that the fires created an onerous threat of flooding and debris flow to life, property, and municipal water supplies on private lands bordering the burned area. An unprecedented effort, accelerated by cooperation from USGS and USFS specialists, resulted in the installation of an **early warning system** within one week of the BAER team arrival.

This BAER Plan is the **initial funding request** for Emergency Fire Rehabilitation funds. This plan may also be used as a justification to seek funding from other sources. Additional supplemental requests may be made after this document has been reviewed and approved by National BAER Coordinators or approval authorities of the various agencies.

At the conclusion of each fiscal year an **Accomplishment Report** will be due to the approval authority. The Accomplishment Report will document the funding received (initial and supplemental funding), treatments installed, the effectiveness of the installed treatments, and the **results of monitoring activities**. Funding must be authorized each fiscal year.

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PART A ~ LOCATION AND BACKGROUND INFORMATION

MISSIONARY RIDGE COMPLEX MISSIONARY RIDGE AND VALLEY FIRES

Fire Name	Missionary Ridge	Date Controlled	
Fire Number	USFS# CO-SJF-26804	Est. contained 7-15-02	
Agency Unit	USFS, San Juan NF BLM , Durango FO State Land Colorado		
		Jurisdiction	Acres
Region	USFS - Region 2 BLM – Durango FO	USFS, San Juan NF	
State	Colorado	BLM , Durango FO	
County(s)	La Plata	Private Colorado	
Ignition Date/Manner	06/09/02--Human	State Land Colorado	
Date Contained	07/14/02 <i>35 JEF</i>	TOTAL ACRES	72,962 ✓

Fire Name	Valley	Date Controlled	7/05/02
Fire Number	CO-SJF-26804		
Agency Unit	USFS San Juan NF		
Region	USFS - Region 2		
State	Colorado		
County(s)	La Plata		
		Jurisdiction	Acres
		USFS – San Juan FS	
Ignition Date/Manner	6/25/02--Electric Fence		
Date Contained	7/03/02	TOTAL ACRES	439



PART B ~ NATURE OF PLAN

I. Type of Plan (check one box below)

	Short-term Rehabilitation (Complete Parts A, B, C, and H only)
	Long-term Rehabilitation (Complete all parts)
✓	Both Long and Short-term Rehabilitation (Completed all Parts)

II. Type of Action (Check One box below)

✓	Initial Submission
	Updating Or Revising The Initial Submission
	Supplying Information For Accomplishment To Date On Work Underway
	Different Phase Of Project Plan
	Final Report (To Comply With The Closure Of The EFR Account ~~z~~ ~~5~~)

PART C ~ REHABILITATION ASSESSMENT

I. Rehabilitation Objectives:

- ☐ Locate and stabilize severely burned slopes that pose a direct threat to human life, property or critically important cultural and natural resources.
- ☐ Recommend post-fire rehabilitation prescriptions that prevent irreversible loss of natural and cultural resources.
- ☐ As practical and necessary, restore natural conditions to areas disturbed by fire suppression actions.
- ☐ Conduct immediate post-burn reconnaissance for fire suppression related impacts to threatened and endangered (T&E) species, and cultural sites.
- ☐ Initiate implementation of treatments, and short-term treatments
- ☐ Provide **long-term monitoring recommendations** intended to ensure the success of rehabilitation efforts.

PART D ~ TEAM ORGANIZATION, TEAM MEMBERS

I. BAER TEAM MEMBERS

Team Leader	Monte Williams, USFS
Operations Lead	Dave Blackford, USFS (Retired)
Documentation	Jackie Twiss, USFS
GIS	Cheryl Beck, USFS ✓ Dan Greene, USFS
Soil & Watershed Lead	Becca Smith, USFS
Hydrology	Mark Story, USFS Michael Parenti, Contractor Shauna Jensen, USFS
Soils	Suzanne Loadholt, Contractor Jeff Redders, USFS
Geology	Sue Cannon, USGS
Geotechnology	Mike Burke, USFS
Engineering	Ray Ollila, USFS (Retired)
Early Warning System	Ralph Teller, USGS Dave Grey, USGS Mark Gress, USGS
Resources Lead	Neal Bosworth
Ecology/Vegetation	Jeff Redders, USFS Will Reitveld, USFS (Retired)
Wildlife	Anthony Garcia, USFS
Range/Weeds	Rowdy Wood, USFS Jennifer Rowe, USFS
Fisheries	Dave Gerhardt, USFS
Cultural	Sean Larmore, USFS
Recreation	Richard Speegle, BLM
Roads	Ray Ollila, USFS (Retired) Paul Christensen, USFS

PART D ~ RESOURCE ADVISORS

III. Resource Advisors

Resource Advisors are individuals who assisted the BAER Team with the preparation of this plan. See Part H of this plan for a full list of agencies and individuals who were consulted or otherwise contributed to the development of this plan.

NAME	AFFILIATION, SPECIALTY
Fred Ellis	San Juan Public Lands, Fire Ecology
Martha Williamson	San Juan Public Lands, Fire Ecology
Chris Berven	San Juan Public Lands, Fire Ecology
Eliza Blumm	San Juan Public Lands, Fire Ecology
Joe Young	San Juan Public Lands, Hydrology
Jeremy Greene	San Juan Public Lands, Hydrology
Kelli Shanahan	San Juan Public Lands, Hydrology



PART E ~ SUMMARY OF ACTIVITIES AND COST

The SUMMARY OF ACTIVITIES table identifies rehabilitation costs proposed for funding from Burned Area Emergency Rehabilitation funding. Funding is pending Regional Office and Washington Office approval, and some specifications may be modified.

Spec #	Part E: Line Item	Cost
1	Early Warning System	\$264,476
2	Log Erosion Barriers	\$1,728,275
3	Aerial Seeding	\$587,105
4	Straw Mulching	\$87,840
5	Spillway Design	\$8,000
6	Engineering Design-Slumps	\$15,000
7	Helicopter Monitoring	\$19,335
8	Monitor and Treat Noxious Weeds	\$360,000
9	Camping Safety Assessment	\$2,454
10	Damage Assessment	\$3,150
11	Culvert Replacement	\$254,766
12	Culvert Replacement	\$168,263
13	Grade Dips	\$234,677
14	Culvert and Ditch Cleaning	\$66,227
15	Warning Signs	\$21,090
16	Road Sign Replacement	\$5,950
17	Trail Drainage Structures	\$145,175
18	Trail Sign Replacement	\$1,744
19	Hazard Tree Treatment	\$28,135
20	Hazard Tree Treatment	\$6,828
21	Hazard Tree Treatment	\$19,276
22	Hazard Tree Treatment Camping 1	\$7,469
23	Hazard Tree Treatment Camping 2	\$20,742
24	Native American Consult	\$5,000
25	Trail Safety	\$24,991
26	Archaeological Monitoring	\$3,868
27	Treatment Effectiveness Monitoring	\$50,260
		\$4,140,096

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PART F ~ SPECIFICATIONS

Specification Number	List of Specifications	Page
1	Early Warning System	15
2	Log Erosion Barriers	19
3	Aerial Seeding	23
4	Straw Mulching	27
5	Engineering Design of Diversion Structure at Lemon Reservoir Spillway	31
6	Engineering Assessment & Design to Stabilize Slumps in Drainages	33
7	Helicopter Monitoring of Debris Jams Following Precipitation Events	35
8	Monitor and Treat Noxious Weeds	43
9	Campground/Campsite Safety Assessment	47
10	Damage Assessment and Treatment of Archaeological Sites	49
11	Culvert Replacement in ephemeral or intermittent drainage	73
12	Culvert Replacement in perennial streams	77
13	Grade Dips	69
14	Culvert and Ditch Cleaning	81
15	Warning Signs Roads and Trails	61
16	Road Sign Replacement	57
17	Replace/Improve Trail Drainage Structures	97
18	Trail Sign Replacement	65
19	Hazard Tree removal along roads, Maintenance level 2,3,4, and 5	89
20	Hazard Tree Treatment - Trails in Wilderness	85
21	Hazard Tree Treatment - Trails not in Wilderness	93
22	Hazard Tree Treatment - In Wilderness Campsites	101
23	Hazard Tree Treatment - Within Campgrounds	103
24	Native American Consultation	51
25	Trail Safety Assessment and Monitoring	53
26	Archaeological Post-Treatment Monitoring	45
27	Treatment Effectiveness Monitoring	39



Firefighter
U.S. Forest Service



**INTERAGENCY
BURNED AREA EMERGENCY STABILIZATION & REHABILITATION PLAN**

PART F - SPECIFICATION

SPECIFICATION TITLE:	EARLY WARNING SYSTEM	JURISDICTIONS:	USFS, USGS, LA PLATA COUNTY
PART E: LINE ITEM:	#1, Early Warning System	FISCAL YEAR:	2002, 2003, 2004

I. WORK TO BE DONE**Number and Describe Each Task:****A. General Description:**

Install automated rain gauges within the burn area that are connected with a remote automated warning system.

B. Location (Suitable) Sites:

See Early Warning Precipitation Stations Map.

C. Design/Construction Specifications:

1. Install 12 data collection platform (DCP) instruments.
2. The weather stations will be programmed to relay "real-time" weather information to the National Weather Service. The National Weather Service will utilize the information to supplement existing forecasting effort and provide information to the La Plata County Office of Emergency Services.
3. The early warning system will be maintained by the USGS.

D. Purpose of Treatment Specifications:

The DCP's will provide an early warning system in response to anticipated flood and debris flow events resulting from the burned areas of the Missionary Ridge and Valley fires. ESR treatments cannot protect life and property from all size floods. The early warning system allows people to evacuate the area when flood hazards are imminent.

E. Treatment Effectiveness Monitoring:

Monitor system's ability to provide adequate warnings in relation to flood and/or debris flows. Station monitoring will be conducted by the USGS.

II. LABOR, MATERIALS AND OTHER COSTS:

PERSONAL SERVICES			
Do not include contract personnel costs here	Cost/Hour	# of Hours	COST/ITEM
GS-12 Hydrologist	\$25.53	240	\$6,127.20
operation and maintenance (USGS)			\$136,200.00
			\$0.00
			\$0.00
			\$0.00
			\$0.00
			\$0.00
			\$0.00
			\$0.00
			\$0.00
			\$0.00
			\$0.00
TOTAL PERSONNEL SERVICE COST			\$142,327.20



EQUIPMENT PURCHASE, LEASE OR RENTAL	Cost/Day- Cost/Hour	# of Days- # of Hours	COST/ITEM
*Purchase requires written justification			
rent DCP instrument (for 3 seasons)			\$55,800.00
			\$0.00
			\$0.00
			\$0.00
			\$0.00
			\$0.00
TOTAL EQUIPMENT PURCH, LEASE, RENT COST			\$55,800.00

MATERIALS AND SUPPLIES	Cost Each	Quantity	COST/ITEM
support equipment and supplies			\$66,400.00
			\$0.00
			\$0.00
			\$0.00
			\$0.00
			\$0.00
TOTAL MATERIALS AND SUPPLIES COST			\$66,400.00

TOTAL COST BY JURISDICTION	UNITS TREATED	COST
USFS		\$264,476.00
TOTAL COST		\$264,476.00



SPECIFICATION COST SUMMARY

FISCAL YEAR	UNIT	UNIT COST	# OF UNITS	COST	FUNDING SOURCE	METHOD
FY 1	Each	9191	12	\$110,292	EFR	P, M
FY 2	Each	6424	12	\$77,092	EFR	P, M
FY 3	Each	6424	12	\$77,092	EFR	P, M
TOTAL		\$0		\$264,476	EFR	

FUNDING SOURCES:

F = Fire Suppression Account

EFR=Emergency Fire Rehabilitation

OP/O =Agency Operating Fund

EWP = Emergency Watershed Program

SPECIFICATION TYPE

ES = Emergency Stabilization

R = Rehabilitation

FS = Fire Suppression

METHODS FOR COMPLETION

P=Agency Personnel Services

C=Contract

EFC= Emergency Fire Contract

FC=Crew Labor Assigned to Fire

SOURCE OF COST ESTIMATE

1. Estimate obtained from 2-3 independent contractual sources.	
2. Documented cost figures from similar project work obtained from local agency sources.	P, M
3. Estimate supported by cost guides from independent sources or other federal agencies.	
4. Estimates based upon government wage rates and material cost.	
5. No cost estimate required – cost charged to Fire Suppression Account.	

P = Personnel Services M = Materials/Supplies T = Travel C = Contract F = Suppression

III. RELEVANT DETAILS, MAPS AND DOCUMENTATION INCLUDED IN THIS REPORT:

List Relevant Documentation and Cross-References Within ESR Plan:

SEE APPENDIX I, SOIL AND WATERSHED ASSESSMENT AND EARLY WARNING PRECIPITATION STATION MAP



**INTERAGENCY
BURNED AREA EMERGENCY STABILIZATION & REHABILITATION PLAN**

Specifications



PART F - SPECIFICATION

SPECIFICATION TITLE:	LOG EROSION BARRIERS	JURISDICTIONS:	USFS
PART E: LINE ITEM:	#2, Log Erosion Barriers	FISCAL YEAR:	2002

I. WORK TO BE DONE

Number and Describe Each Task:

- A. General Description:** Areas of moderate and high burn severity have low ground cover and have lost most of the organic layer protecting the soil. As a result overland flow from these areas increases after a fire. The increase in overland flow causes the formation of rills and eventually gullies and increases the effective channel length. The increase in effective channel length decreases the time of concentration and delivers runoff to stream channels more rapidly and in greater volumes relative to pre-fire conditions. The increase in runoff volume and the change in runoff timing can produce localized flooding and initiate debris flows in geologic formations with stream conditions (Order 1 channels with steep gradients) susceptible to debris flows.
- B. Location (Suitable) Sites:** Moderate and high severity burn areas with slopes <40% which are near or easily accessed by the current road system (See Appendix III – Hillslope Treatment Map). It is assumed that approximately 50% of the area identified on the map will be technically, logistically, and safe to treat.
- C. Design/Construction Specifications:**
1. Tree Size -- The preferred tree is 8" to 12" dbh. Dbh should not exceed 12". Down logs may also be used if they are solid enough to act as an erosion barrier.
 2. Species -- Straight conifer trees will be used. Only dead trees will be cut for logs.
 3. Construction Process -- First, the appropriate tree is fallen parallel to the contour of the slope (perpendicular to the fall line of the slope using a chainsaw or low ground pressure feller buncher (less than 3psi)). Second, The underside of the tree is limbed, starting at the lowest limbs to an upper tree diameter of 4 inches. This allows for the tree bole to make contact with the ground. Third, secure stump end of tree behind the uphill side of the stump. Fourth, if the upper portion of tree is not locked behind other standing trees, then secure that portion of the tree with wooden pegs driven into the soil.
 4. Stumps -- Stumps should be at least 12' high, but on steeper slopes can be up to 18' high.
 5. Logs -- Logs should be as long as possible and down to 4" in diameter. Logs may need to be shortened to 10' to 15' in dissected terrain. The entire length must be in contact with the soil, and positioned on the contour, perpendicular to the slope.
 6. Bedding -- Each log is bedded in a shallow trench, with an upslope backfill to seal the log to the soil such that water does not flow beneath the log. Both the trench and backfill are made with a hazel hoe or Pulaski scalping tool. Logs must be level, and positioned perpendicular to the overland flow path of water. Where the log cannot be leveled against stumps or natural features, a short stake may be driven into the soil to keep it from rolling. The stake can be a tree limb, rock or sawn stake.
 7. Density -- The preferred density is 40 logs per acre, but can go as low as 30 logs per acre if trees are scarce. To judge when an acceptable density is achieved, use a spacing of 20' X 20'.
 8. Progress -- It is best to begin at the top of the unit and work down. That way the person bedding the logs can stay out of the way of falling trees.
 9. Equipment -- Chain saw with safety equipment; Hazel Hoe or Pulaski for bedding logs; a single bit axe is sometimes used to cut and pound stakes; use small (8") carpenter level to level the logs.
 10. Protection of Cultural Resources -- The workers must protect all cultural resources by not dropping trees or bedding logs on these sites. Each site must be reported to the team leader.
 11. Bypass Areas -- There will be islands within each designated treatment block that are low priority for log terraces, including:
 - a. Where surface rock will not allow for bedding of the log erosion barrier, move to the nearest suitable location.
 - b. Slopes greater than approximately 60% are usually offer poor footing and can be bypassed. Slopes less than 40% will be treated by mechanized equipment.



- c. Where surface rock, 4" diameter and larger cover over 60% of the soil surface.
 - d. Where trees are greater than 12" diameter, then there are no candidate trees, and the area should be bypassed.
 - e. Openings where trees do not grow should be bypassed. f. If not enough suitable trees are available, only those trees that meet the selection criteria are felled.
- D. Purpose of Treatment Specifications:** Log erosion barriers are designed to promote infiltration of overland flow, decrease the frequency of rill and gully formation, and reduce slope length. A benefit of log erosion barriers is to store sediment, however the sediment storage capacity of log erosion barriers is often exceeded after the ash wash occurs on moderate and high burn severity hillslopes.
- E. Treatment Effectiveness Monitoring:** Monitor sediment storage capacity annually. Monitor rill and gully formation in treated areas.

II. LABOR, MATERIALS AND OTHER COSTS:

PERSONAL SERVICES			
Do not include contract personnel costs here	Cost/Hour	# of Hours	COST/ITEM
GS-9 Hydrologist	\$18.16	360	\$6,537.60
GS-5 Hydrologic Technician	\$13.49	360	\$4,856.40
GS-5 Hydrologic Technician	\$11.98	360	\$4,312.80
GS-12 Contracting Officer	\$23.94	360	\$8,618.40
			\$0.00
			\$0.00
			\$0.00
			\$0.00
			\$0.00
			\$0.00
			\$0.00
			\$0.00
			\$0.00
TOTAL PERSONNEL SERVICE COST			\$24,325.20

MATERIALS AND SUPPLIES			
	Cost Each	Quantity	COST/ITEM
Wood stakes	\$0.32	10,000	\$3,200.00
Vehicle fuel	\$1.50	500	\$750.00
			\$0.00
			\$0.00
			\$0.00
			\$0.00
TOTAL MATERIALS AND SUPPLIES COST			\$3,950.00



TOTAL COST BY JURISDICTION	UNITS TREATED	COST
USFS	3,750	\$1,728,275.20
TOTAL COST		\$1,728,275.20

SPECIFICATION COST SUMMARY

FISCAL YEAR	UNIT	UNIT COST	# OF UNITS	COST	FUNDING SOURCE	METHOD
FY 1	Acre	460.87	3,750	1,728,275.20	ES	P,C
FY 2						
FY 3						
TOTAL		\$0	3,750	1,728,275.20		

FUNDING SOURCES:

F = Fire Suppression Account

EFR=Emergency Fire Rehabilitation

OP/O =Agency Operating Fund

EWP = Emergency Watershed Program

SPECIFICATION TYPE

ES = Emergency Stabilization

R = Rehabilitation

FS = Fire Suppression

METHODS FOR COMPLETION

P=Agency Personnel Services

C=Contract

EFC= Emergency Fire Contract

FC=Crew Labor Assigned to Fire

SOURCE OF COST ESTIMATE

1. Estimate obtained from 2-3 independent contractual sources.	
2. Documented cost figures from similar project work obtained from local agency sources.	P
3. Estimate supported by cost guides from independent sources or other federal agencies.	C
4. Estimates based upon government wage rates and material cost.	P
5. No cost estimate required – cost charged to Fire Suppression Account.	

P = Personnel Services M = Materials/Supplies T = Travel C = Contract F = Suppression

III. RELEVANT DETAILS, MAPS AND DOCUMENTATION INCLUDED IN THIS REPORT:

List Relevant Documentation and Cross-References Within ESR Plan:

SEE APPENDIX I, SOIL AND WATERSHED ASSESSMENT AND APPENDIX III, HILLSLOPE TREATMENT MAP.



INTERAGENCY BURNED AREA EMERGENCY STABILIZATION & REHABILITATION PLAN

PART F - SPECIFICATION

SPECIFICATION TITLE:	Aerial Seeding	JURISDICTIONS:	USFS
PART E: LINE ITEM:	#3, Aerial Seeding	FISCAL YEAR:	2002

I. WORK TO BE DONE

Number and Describe Each Task:

A. General Description: Aerial seeding will be completed with contract aircraft and pilots. The treatment areas displayed (in different colors) on the "Seeding Areas" map show specific seeding prescriptions (seed mix and rate) for each area.

B. Location (Suitable) Sites: Seeding locations have been mapped by the BAER team. All areas of high burn severity with values of risk below will be seeded. Only State certified noxious weed-free seed will be used. Three seed mixes will be used at rates of 32#/acre.

C. Design/Construction Specifications:

1. The seed mixture for the Missionary Ridge Complex was compiled jointly by BAER team specialists and SJNF Resource specialists. Seed must be tested for purity and germination rates, and must be certified noxious weed free. Before accepting delivery of seed shipment, the contractor must provide written evidence (seed label) to the contracting officer that the seed conforms to the purity and germination requirements. Test methods specified in Rules for Testing Seeds, Proceedings and the Association of Official Seed Analyst will be acceptable for determining the germination rates.
2. Delivery: Deliver to Durango, Colorado
3. Storage: Seed should be applied as soon as possible after delivery. If immediate application is not possible the seed should be stored in a cool, dry place. On site stored seed must be protected from dew and rain
4. Application rate: Seed should be applied at approximately 32# per acre
5. Application Method: Pilot will utilize GPS equipment during application and line of sight and personal direction.\
6. Seed mixes:

West side of Missionary Ridge and the Valley Fire (in red on seeding areas map):

area	pounds/acre	seeds/square foot	Cost/PLS
Spring wheat	12	3.9	\$0.14/lb
Annual rye	12	62.5	\$0.45/lb
Mt. Brome	3	6.2	\$2.30/lb
Slender Wheatgrass	2.5	9.1	\$1.30/lb
Western Wheatgrass	2.5	6.3	\$2.50/lb

South Missionary Ridge and the Florida River drainage (in green on seeding areas map):

area	pounds/acre	seeds/square foot	Cost/PLS
Spring wheat	8	3.9	\$0.14/lb
Annual rye	8	62.5	\$0.45/lb
Mt. Brome	6	6.2	\$2.30/lb
Slender Wheatgrass	5	9.1	\$1.30/lb
Western Wheatgrass	5	6.3	\$2.50/lb

Pine River drainage (in gray on seeding areas map):

area	pounds/acre	seeds/square foot	Cost/PLS
Spring wheat	8	3.9	\$0.14/lb
Annual rye	8	62.5	\$0.45/lb
Mt. Brome	8	6.2	\$2.30/lb
Slender Wheatgrass	8	9.1	\$1.30/lb



- D. Purpose of Treatment Specifications:** Seeding can be an effective erosion control technique provided a consistently uniform cover is obtained. Subsequent establishment is dependent upon favorable precipitation patterns. Effectiveness is directly related to cover density.
- E. Treatment Effectiveness Monitoring:** Where site conditions are dry, sandy, or rocky seeding may not be successful. Monitoring will be done to evaluate effectiveness of seeding. Supplemental seeding requests may be warranted should monitoring determine that initial seeding did not meet resource protection objectives.

II. LABOR, MATERIALS AND OTHER COSTS:

PERSONAL SERVICES			
Do not include contract personnel costs here	Cost/Hour	# of Hours	COST/ITEM
Contractor Officer's Representative GS-9 @ \$200/day for 12 days	\$200.00	12	\$2,400.00
5 person helicopter loading crew @ \$119/day for 10 days	\$119.00	10	\$1,190.00
Monitoring person to insure proper seed application GS-9 @ \$200/day for 6 days	\$200.00	6	\$1,200.00
			\$0.00
			\$0.00
			\$0.00
			\$0.00
			\$0.00
			\$0.00
			\$0.00
			\$0.00
			\$0.00
			\$0.00
TOTAL PERSONNEL SERVICE COST			\$4,790.00

MATERIALS AND SUPPLIES			
	Cost Each	Quantity	COST/ITEM
Seed: West side of Missionary Ridge and Valley Fire	\$23.48/acre	5678 acres	\$133, 319
Seed: South side, Florida River drainage	\$37.52/acre	3276 acres	\$122, 915
Seed: East side, Pine River drainage	\$33.52/acre	6006 acres	\$201, 321
			\$0.00
			\$0.00
			\$0.00
TOTAL MATERIALS AND SUPPLIES COST			\$457, 555

CONTRACT COST			
	Cost/Hour	# of Hours	COST/ITEM
2 Jet Ranger helicopters @ \$600/hr x 200 hours total flight time	\$600.00	200	\$120,000.00
			\$0.00
			\$0.00
			\$0.00
			\$0.00
TOTAL CONTRACT COST			\$120,000.00



TOTAL COST BY JURISDICTION	UNITS TREATED	COST
USFS	14, 950 acres	\$587,105.00
TOTAL COST		\$587,105.00

SPECIFICATION COST SUMMARY

FISCAL YEAR	UNIT	UNIT COST	# OF UNITS	COST	FUNDING SOURCE	METHOD
FY 1	Acres	\$39.27	14,950	\$587,105	EFR	P,C
FY 2						
FY 3						
TOTAL				\$587,105	EFR	

FUNDING SOURCES:

F = Fire Suppression Account

EFR=Emergency Fire Rehabilitation

OP/O =Agency Operating Fund

EWP = Emergency Watershed Program

SPECIFICATION TYPE

ES = Emergency Stabilization

R = Rehabilitation

FS = Fire Suppression

METHODS FOR COMPLETION

P=Agency Personnel Services

C=Contract

EFC= Emergency Fire Contract

FC=Crew Labor Assigned to Fire

SOURCE OF COST ESTIMATE

1. Estimate obtained from 2-3 independent contractual sources.	M
2. Documented cost figures from similar project work obtained from local agency sources.	C
3. Estimate supported by cost guides from independent sources or other federal agencies.	
4. Estimates based upon government wage rates and material cost.	P
5. No cost estimate required – cost charged to Fire Suppression Account.	

P = Personnel Services M = Materials/Supplies T = Travel C = Contract F = Suppression

III. RELEVANT DETAILS, MAPS AND DOCUMENTATION INCLUDED IN THIS REPORT:

List Relevant Documentation and Cross-References Within ESR Plan:

SEE APPENDIX I, VEGETATION RESOURCE ASSESSMENT: AND APPENDIX III, SEEDING AREAS



INTERAGENCY BURNED AREA EMERGENCY STABILIZATION & REHABILITATION PLAN

PART F - SPECIFICATION

SPECIFICATION TITLE:	HELICOPTER MONITORING OF DEBRIS JAMS FOLLOWING PRECIPITATION EVENTS	JURISDICTIONS:	USFS
PART E: LINE ITEM:	#4, Straw Mulching	FISCAL YEAR:	2002

I. WORK TO BE DONE

Number and Describe Each Task:

A. General Description:

Straw mulch is applied where existing ground cover was consumed by the fire and the expected overland runoff would threaten values at risk. First year effectiveness includes stabilizing ashes onsite, preventing loss of topsoil, improving infiltration rate and replacing organic litter consumed by the fire. Mulching has a secondary benefit of reducing flood peaks downstream of the treatment area. For the City of Durango water intake this mulching treatment will reduce ash and sediment (water quality) impacts.

B. Location (Suitable) Sites:

Slopes above the SW side of Lemon Reservoir and downstream (northwest of the Florida) for about 1.5 miles and on USFS land in the Valley Fire.

C. Design/Construction Specifications:

1. **Site Selection:** Treatment areas were designated on the BAER treatment map and in the field by the BAER team.
2. **Type of Straw:** Straw must be certified free of noxious plants listed in the Forest Service noxious plant handbook. Suitable straw includes barley, wheat, pasture grasses, rice, bean and prairie grasses. Species selected should be neutral or compatible with the botanical community. Strips to be treated are 300-500'. Mulch is usually applied by hand crews. The rate of application is a minimum of 2,000 pounds per acre. This is about 25 bales per acre, spread 2 inches deep, if evenly distributed.

D. Purpose of Treatment Specifications:

The basic purpose of straw mulch is to replace the natural ground cover density that was consumed by the fire. By controlling the overland runoff, the top soil is also protected. Especially important is to stabilize the ashes onsite, because they represent the nutrient capital. Straw mulch can also: 1) Break the impact of raindrops and prevent soil compaction; 2) maintain a favorable moisture regime for sprouting seeds that are stored in the soil, and applied as an emergency treatment; 3) Protect and often prevent frost heave of topsoils, which can damage root systems of annual plants; 4) Insulate the topsoil from solar isolation, and provide a more favorable temperature range for new plants; 5) Provide a growing medium for plants; and 6) Effectively control sediment loss from a burned area. By treating the source of floodwaters after a burn, the immediate downslope area can also be effectively protected. Rills and gullies that originate on extremely hot burns can migrate downslope from the place of origin and scour the slope for several hundred feet. Therefore small areas of less than one acre can often be mulched to protect much larger, downslope areas from the cumulative effect of hillslope runoff.

E. Treatment Effectiveness Monitoring:

Monitor mulches ability to stabilize ashes onsite, prevent loss of topsoil, improve infiltration rate and replace organic litter consumed by the fire.



II. LABOR, MATERIALS AND OTHER COSTS:

PERSONAL SERVICES			
Do not include contract personnel costs here	Cost/Hour	# of Hours	COST/ITEM
Two Type II crews	\$700.00	40	\$28,000.00
San Juan National Forest coordinator	\$18.16	60	\$1,089.60
			\$0.00
			\$0.00
			\$0.00
			\$0.00
			\$0.00
			\$0.00
			\$0.00
			\$0.00
			\$0.00
			\$0.00
			\$0.00
			\$0.00
TOTAL PERSONNEL SERVICE COST			\$29,089.60

MATERIALS AND SUPPLIES			
	Cost Each	Quantity	COST/ITEM
straw bales	\$5.00	4250	\$21,250.00
cover crop seed	\$5.00	5100	\$25,500.00
			\$0.00
			\$0.00
			\$0.00
			\$0.00
TOTAL MATERIALS AND SUPPLIES COST			\$46,750.00

CONTRACT COST			
	Cost/Hour	# of Hours	COST/ITEM
Helicopter to haul straw bales to treatment areas	\$600.00	20	\$12,000.00
			\$0.00
			\$0.00
			\$0.00
			\$0.00
TOTAL CONTRACT COST			\$12,000.00



TOTAL COST BY JURISDICTION	UNITS TREATED	COST
USFS		\$87,840.00
TOTAL COST		\$87,840.00

SPECIFICATION COST SUMMARY

FISCAL YEAR	UNIT	UNIT COST	# OF UNITS	COST	FUNDING SOURCE	METHOD
FY 1	Acres	\$517.71	170	\$87,840	EFR	FC, EFC
FY 2						
FY 3						
TOTAL		\$0		\$87,840		

FUNDING SOURCES:

F = Fire Suppression Account
 EFR=Emergency Fire Rehabilitation
 OP/O =Agency Operating Fund
 EWP = Emergency Watershed Program

SPECIFICATION TYPE

ES = Emergency Stabilization
 R = Rehabilitation
 FS = Fire Suppression

METHODS FOR COMPLETION

P=Agency Personnel Services
 C=Contract
 EFC= Emergency Fire Contract
 FC=Crew Labor Assigned to Fire

SOURCE OF COST ESTIMATE

1. Estimate obtained from 2-3 independent contractual sources.	
2. Documented cost figures from similar project work obtained from local agency sources.	P, M
3. Estimate supported by cost guides from independent sources or other federal agencies.	
4. Estimates based upon government wage rates and material cost.	P, M
5. No cost estimate required – cost charged to Fire Suppression Account.	

P = Personnel Services M = Materials/Supplies T = Travel C = Contract F = Suppression

III. RELEVANT DETAILS, MAPS AND DOCUMENTATION INCLUDED IN THIS REPORT:

List Relevant Documentation and Cross-References Within ESR Plan:

SEE APPENDIX I, SOIL AND WATERSHED RESOURCE ASSESSMENT. SEE APPENDIX III, HILLSLOPE TREATMENT MAP





**INTERAGENCY
BURNED AREA EMERGENCY STABILIZATION & REHABILITATION PLAN**

PART F - SPECIFICATION

SPECIFICATION TITLE:	ENGINEERING DESIGN OF DIVERSION STRUCTURE AT LEMON RESERVOIR SPILLWAY	JURISDICTIONS:	USFS
PART E: LINE ITEM:	#5, Spillway Design	FISCAL YEAR:	2002

I. WORK TO BE DONE

Number and Describe Each Task:

A. General Description:

Engineer will design a diversion structure to divert water and debris away from the Lemon Dam spillway.

B. Location (Suitable) Sites:

Lemon Dam spillway.

C. Design/Construction Specifications:

1. Evaluate location for a diversion structure at Lemon Dam spillway.
2. Complete engineering design, including design specification, construction cost estimates, and any required construction drawings or diagrams for the diversion structure.

D. Purpose of Treatment Specifications:

To protect Lemon Reservoir spillway from damage by flood flows and debris.

E. Treatment Effectiveness Monitoring:

NA

II. LABOR, MATERIALS AND OTHER COSTS:

CONTRACT COST	Cost/Unit	# of Units	COST/ITEM
Engineer	\$100.00	80	\$8,000.00
			\$0.00
			\$0.00
			\$0.00
			\$0.00
TOTAL CONTRACT COST			\$8,000.00

TOTAL COST BY JURISDICTION	UNITS TREATED	COST
USFS		\$8,000.00
TOTAL COST		\$8,000.00



SPECIFICATION COST SUMMARY

FISCAL YEAR	UNIT	UNIT COST	# OF UNITS	COST	FUNDING SOURCE	METHOD
FY 1	Hours	\$100	80	\$8,000	EFR	C
FY 2						
FY 3						
TOTAL	Hours	\$100	80	\$8,000	EFR	C

FUNDING SOURCES:

F = Fire Suppression Account

EFR=Emergency Fire Rehabilitation

OP/O =Agency Operating Fund

EWP = Emergency Watershed Program

SPECIFICATION TYPE

ES = Emergency Stabilization

R = Rehabilitation

FS = Fire Suppression

METHODS FOR COMPLETION

P=Agency Personnel Services

C=Contract

EFC= Emergency Fire Contract

FC=Crew Labor Assigned to Fire

SOURCE OF COST ESTIMATE

1. Estimate obtained from 2-3 independent contractual sources.	
2. Documented cost figures from similar project work obtained from local agency sources.	
3. Estimate supported by cost guides from independent sources or other federal agencies.	C
4. Estimates based upon government wage rates and material cost.	
5. No cost estimate required – cost charged to Fire Suppression Account.	

P = Personnel Services M = Materials/Supplies T = Travel C = Contract F = Suppression

III. RELEVANT DETAILS, MAPS AND DOCUMENTATION INCLUDED IN THIS REPORT:

List Relevant Documentation and Cross-References Within ESR Plan:

SEE APPENDIX 1, SOIL AND WATERSHED RESOURCE ASSESSMENT, VALUES AT RISK MAP, FOR MORE DETAILS AND LOCATIONS

**INTERAGENCY
BURNED AREA EMERGENCY STABILIZATION & REHABILITATION PLAN**

PART F - SPECIFICATION

SPECIFICATION TITLE:	ENGINEERING ASSESSMENT & DESIGN TO STABILIZE SLUMPS IN DRAINAGES	JURISDICTIONS:	USFS
PART E: LINE ITEM:	#6, Engineering Design-Slumps	FISCAL YEAR:	2002

I. WORK TO BE DONE**Number and Describe Each Task:****A. General Description:**

Geologist or geotechnical engineer will conduct an assessment of potential reactivation of currently inactive landslides due to increased flood flows undercutting the toe of the slumps. Prepare a report including the development of treatment recommendations to address identified hazards.

B. Location (Suitable) Sites:

In watersheds above values at risk as identified in the soil and watershed resource assessment.

C. Design/Construction Specifications:

1. Assess risk of the entire watershed above identified value at risk. Define the potential risks associated with reactivated slumps in drainages over both short- and long-term timeframes and provide estimated volume of material available for transport. Determine where deposition is likely to occur and if stream channels are likely to be dammed.
2. Produce a map with specific geologic hazard locations and a written report including observations, conclusions, treatment recommendations, design specifications for specific treatment (including probability of success), and detailed cost estimates.
3. Prioritize hazards.
4. Include in the report the management circumstances of concern and estimate the time interval required to mitigate the threat to the values at risk, both with and without treatment.

D. Purpose of Treatment Specifications:

To identify potential geologic hazards and recommend type and locations of treatments to mitigate hazards. The slumps have the potential to reactivate, dam drainages and potentially cause a large peak flow should the dam breach.

E. Treatment Effectiveness Monitoring:

NA

II. LABOR, MATERIALS AND OTHER COSTS:

CONTRACT COST	Cost/Hour	# of Hours	COST/ITEM
Geologist/geotechnical engineer	\$125.00	120	\$15,000.00
			\$0.00
			\$0.00
			\$0.00
			\$0.00
TOTAL CONTRACT COST			\$15,000.00

TOTAL COST BY JURISDICTION	UNITS TREATED	COST
USFS	1	\$15,000.00
TOTAL COST		\$15,000.00



SPECIFICATION COST SUMMARY

FISCAL YEAR	UNIT	UNIT COST	# OF UNITS	COST	FUNDING SOURCE	METHOD
FY 1	Hours	\$125	120	\$15,000	EFR	C
FY 2						
FY 3						
TOTAL		\$125	120	\$15,000	EFR	C

FUNDING SOURCES:

F = Fire Suppression Account

EFR=Emergency Fire Rehabilitation

OP/O =Agency Operating Fund

EWP = Emergency Watershed Program

SPECIFICATION TYPE

ES = Emergency Stabilization

R = Rehabilitation

FS = Fire Suppression

METHODS FOR COMPLETION

P=Agency Personnel Services

C=Contract

EFC= Emergency Fire Contract

FC=Crew Labor Assigned to Fire

SOURCE OF COST ESTIMATE

1. Estimate obtained from 2-3 independent contractual sources.	
2. Documented cost figures from similar project work obtained from local agency sources.	
3. Estimate supported by cost guides from independent sources or other federal agencies.	C
4. Estimates based upon government wage rates and material cost.	
5. No cost estimate required – cost charged to Fire Suppression Account.	

P = Personnel Services M = Materials/Supplies T = Travel C = Contract F = Suppression

III. RELEVANT DETAILS, MAPS AND DOCUMENTATION INCLUDED IN THIS REPORT:

List Relevant Documentation and Cross-References Within ESR Plan:

SEE APPENCIX III, SOIL AND WATERSHED RESOURCE ASSESSMENT, AND APPENDIX III, VALUES AT RISK MAP



**INTERAGENCY
BURNED AREA EMERGENCY STABILIZATION & REHABILITATION PLAN**

PART F - SPECIFICATION

SPECIFICATION TITLE:	HELICOPTER MONITORING OF DEBRIS JAMS FOLLOWING PRECIPITATION EVENTS	JURISDICTIONS:	USFS
PART E: LINE ITEM:	#7, Helicopter Monitoring	FISCAL YEAR:	2002, 2003

I. WORK TO BE DONE

Number and Describe Each Task:

A. General Description:

Aerial reconnaissance of burned watersheds following precipitation events that have the potential to move debris.

B. Location (Suitable) Sites:

High burn severity watersheds along the East Animas Valley, Jack Creek, Vallecito, Wilson Creek and other watersheds with the potential for large debris jams.

C. Design/Construction Specifications:

1. Aerial reconnaissance of potential debris jam areas following significant precipitation events.
2. Locate debris jams in relation to values at risk as identified in the Soil and Watershed Resource Assessment.

D. Purpose of Treatment Specifications:

To locate debris jams in drainages shortly after they form to allow for controlled breaching. Controlled breaching will reduce the risk of a catastrophic breaching and large peak flows.

E. Treatment Effectiveness Monitoring:

NA

II. LABOR, MATERIALS AND OTHER COSTS:

PERSONAL SERVICES			
Do not include contract personnel costs here	Cost/Hour	# of Hours	COST/ITEM
GS-9 Hydrologist	\$18.16	30	\$544.80
GS-12 Geologist	\$26.33	30	\$789.90
			\$0.00
			\$0.00
			\$0.00
			\$0.00
			\$0.00
			\$0.00
			\$0.00
			\$0.00
			\$0.00
			\$0.00
TOTAL PERSONNEL SERVICE COST			\$1,334.70



CONTRACT COST	Cost/Hour	# of Hours	COST/ITEM
Helicopter	\$600.00	30	\$18,000.00
			\$0.00
			\$0.00
			\$0.00
			\$0.00
TOTAL CONTRACT COST			\$18,000.00

A.

TOTAL COST BY JURISDICTION	UNITS TREATED	COST
USFS	15	\$19,335.00
TOTAL COST		\$19,335.00

SPECIFICATION COST SUMMARY

FISCAL YEAR	UNIT	UNIT COST	# OF UNITS	COST	FUNDING SOURCE	METHOD
FY 1	Hours	\$1,289	15	\$19,335	EFR	P/C
FY 2						
FY 3						
TOTAL	Hours	\$1,289	15	\$19,335	EFR	P/C

FUNDING SOURCES:

F = Fire Suppression Account
 EFR=Emergency Fire Rehabilitation
 OP/O =Agency Operating Fund
 EWP = Emergency Watershed Program

SPECIFICATION TYPE

ES = Emergency Stabilization
 R = Rehabilitation
 FS = Fire Suppression

METHODS FOR COMPLETION

P=Agency Personnel Services
 C=Contract
 EFC= Emergency Fire Contract
 FC=Crew Labor Assigned to Fire

**SOURCE OF COST ESTIMATE**

1. Estimate obtained from 2-3 independent contractual sources.	
2. Documented cost figures from similar project work obtained from local agency sources.	P
3. Estimate supported by cost guides from independent sources or other federal agencies.	C
4. Estimates based upon government wage rates and material cost.	
5. No cost estimate required – cost charged to Fire Suppression Account.	

P = Personnel Services M = Materials/Supplies T = Travel C = Contract F = Suppression

III. RELEVANT DETAILS, MAPS AND DOCUMENTATION INCLUDED IN THIS REPORT:

List Relevant Documentation and Cross-References Within ESR Plan:

SEE APPENDIX I, SOIL AND WATERSHED RESOURCE ASSESSMENT

Specifications



INTERAGENCY BURNED AREA EMERGENCY STABILIZATION & REHABILITATION PLAN

PART F - SPECIFICATION

SPECIFICATION TITLE:	TREATMENT EFFECTIVENESS MONITORING	JURISDICTIONS:	USFS
PART E: LINE ITEM:	#27, Treatment Effectiveness Monitoring	FISCAL YEAR:	2002, 2003, 2004

I. WORK TO BE DONE

Number and Describe Each Task:

A. General Description:

Monitor stream channel dimensions to determine effectiveness of BAER treatments at reducing erosion and runoff after the fire.

B. Location (Suitable) Sites:

The following watersheds are suitable sites:

Watershed
N8
N6
N7
E12-22
N12
NORTH FORK COON CREEK
N5
VALLECITO WEST E3
MIDDLE FORK COON CREEK
V22
KROEGER CREEK 1
WILSON CREEK E23-25
X-SECTION NEAR N19
SOUTH FORK COON CREEK
E1 JACK CREEK
FREED CANYON
E4-12
E27-33 TRUE CRE
N10
E34 RED CREEK
N1 COON CREEK

Refer to Analysis Watersheds map in Appendix III for further detail. Paired sites will be located in treated and untreated tributaries with equivalent drainage areas, similar burn severities, and analogous channel types.

C. Design/Construction Specifications:

1. Locate paired sites in treated and untreated perennial tributaries with equivalent drainage areas, similar burn severities, and analogous channel types.
2. At each site, establish permanent cross-section markers and benchmarks.
3. Survey stream cross-sections. Determine active channel width, bankfull elevation, and cross-sectional area.
4. Install scour chains.
5. Measure substrate composition using Wolman Pebble Count.
6. Collect substrate sample and assess substrate embeddedness using sieve analysis.



7.	Repeat items 3-6 annually for 3 years.
8.	Install 2 recording rain gauges per watershed.
9.	Install crest stage gauges at each cross-section.
D.	Purpose of Treatment Specifications: To determine if BAER treatments were effective in reducing the effects of fire on erosion and runoff.
E.	Treatment Effectiveness Monitoring: NA

II. LABOR, MATERIALS AND OTHER COSTS:

PERSONAL SERVICES			
Do not include contract personnel costs here	Cost/Hour	# of Hours	COST/ITEM
GS-9 Hydrologist	\$18.16	850	\$15,436.00
GS-5 Hydrologic Technician	\$11.98	890	\$10,662.20
GS-5 Hydrologic Technician	\$11.98	890	\$10,662.20
			\$0.00
			\$0.00
			\$0.00
			\$0.00
			\$0.00
			\$0.00
			\$0.00
			\$0.00
			\$0.00
			\$0.00
TOTAL PERSONNEL SERVICE COST			\$36,760.40

MATERIALS AND SUPPLIES			
	Cost Each	Quantity	COST/ITEM
Recording rain gauges	\$250.00	42	\$10,500.00
Crest stage gauges	\$150.00	20	\$3,000.00
			\$0.00
			\$0.00
			\$0.00
			\$0.00
TOTAL MATERIALS AND SUPPLIES COST			\$13,500.00

A.

TOTAL COST BY JURISDICTION	UNITS TREATED	COST
USFS	1	\$50,260.00
TOTAL COST		\$50,260.00

SPECIFICATION COST SUMMARY

FISCAL YEAR	UNIT	UNIT COST	# OF UNITS	COST	FUNDING SOURCE	METHOD
FY 1	Surveys	\$50,260	1	\$50,260	OP/O	P
FY 2						
FY 3						
TOTAL	Surveys	\$50,260	1	\$50,260	OP/P	P

FUNDING SOURCES:

F = Fire Suppression Account
 EFR=Emergency Fire Rehabilitation
 OP/O =Agency Operating Fund
 EWP = Emergency Watershed Program

SPECIFICATION TYPE

ES = Emergency Stabilization
 R = Rehabilitation
 FS = Fire Suppression

METHODS FOR COMPLETION

P=Agency Personnel Services
 C=Contract
 EFC= Emergency Fire Contract
 FC=Crew Labor Assigned to Fire

SOURCE OF COST ESTIMATE

1. Estimate obtained from 2-3 independent contractual sources.	
2. Documented cost figures from similar project work obtained from local agency sources.	P, M
3. Estimate supported by cost guides from independent sources or other federal agencies.	
4. Estimates based upon government wage rates and material cost.	
5. No cost estimate required – cost charged to Fire Suppression Account.	

P = Personnel Services M = Materials/Supplies T = Travel C = Contract F = Suppression

III. RELEVANT DETAILS, MAPS AND DOCUMENTATION INCLUDED IN THIS REPORT:

List Relevant Documentation and Cross-References Within ESR Plan:

SEE APPENDIX I, SOIL AND WATERSHED RESOURCE ASSESSMENT



BURNED AREA EMERGENCY STABILIZATION & REHABILITATION PLAN

PART F - SPECIFICATION

SPECIFICATION TITLE:	Monitor and Treat Noxious Weeds	JURISDICTIONS:	USFS
PART E: LINE ITEM:	#8, Monitor and Treat Noxious Weeds	FISCAL YEAR:	2002

I. WORK TO BE DONE

Number and Describe Each Task:

A. General Description:

1. Monitor and Treat noxious weeds

B. Location (Suitable) Sites:

Missionary Ridge Complex (entire acreage)

C. Design/Construction Specifications:

1. N/A

D. Purpose of Treatment Specifications:

To prevent spread of noxious weeds

E. Treatment Effectiveness Monitoring:

II. LABOR, MATERIALS AND OTHER COST:

PERSONNEL SERVICES (Grade @ Cost/Hours X # Hours X # Fiscal Years = Cost/Item): Do not include contract personnel costs here (see contractor services below).	COST/ITEM
GS-9 @ \$17.00/hr X 160 hrs X 3 years=\$8,160; 4 GS-4@ 10.58/hr X 800 hrs X 3 years= \$101,568	\$109,728
TOTAL PERSONNEL SERVICE COST	\$109,728
EQUIPMENT PURCHASE, LEASE OR RENTAL (Item @ Cost/Hour or Cost/Day X # Hours or # Days X # Fiscal Years = Cost/Item): (Note: Purchase requires written justification that demonstrates cost/item benefits over lease or rental.)	COST/ITEM
weed sprayer X 2@ \$6,000 ea = \$12,000	\$12,000
TOTAL EQUIPMENT PURCHASE, LEASE, OR RENTAL COST	\$12,000
MATERIALS AND SUPPLIES (Item @ Cost/Each X Quantity X # Fiscal Years = Cost/Item):	COST/ITEM
Herbicide @ \$6,000 X 3 years = \$18,000	\$18,000
TOTAL MATERIALS AND SUPPLY COST	\$18,000
TRAVEL COST (Personnel or Equipment @ Rate X Round Trips X # Fiscal Years = Cost/Item):	COST/ITEM
TOTAL TRAVEL COST	\$0

Specifications



CONTRACT COST (Labor or Equipment @ Cost/Hour X # Hours X # Fiscal Years = Cost/Item):	COST/ITEM
Contract weed spraying \$150/acre X 400acres/yr X 3 years= \$180,000	\$180,000
TOTAL CONTRACT COST	\$180,000

SPECIFICATION COST SUMMARY

FISCAL YEAR	UNIT	UNIT COST	# OF UNITS	COST	FUNDING SOURCE	METHOD
FY 1	Acres	\$150	800 acres	\$120,000	EFR/OP	C/P
FY 2	Acres	\$150	800 acres	\$120,000	EFR/OP	C/P
FY 3	Acres	\$150	800 acres	\$120,000	EFR/OP	C/P
TOTAL		\$150	2400 acres	\$360,000		

FUNDING SOURCES:

F = Fire Suppression Account
 EFR=Emergency Fire Rehabilitation
 OP/O =Agency Operating Fund
 EWP = Emergency Watershed Program

SPECIFICATION TYPE

ES = Emergency Stabilization
 R = Rehabilitation
 FS = Fire Suppression

METHODS FOR COMPLETION

P=Agency Personnel Services
 C=Contract
 EFC= Emergency Fire Contract
 FC=Crew Labor Assigned to Fire

SOURCE OF COST ESTIMATE

1. Estimate obtained from 2-3 independent contractual sources.	C
2. Documented cost figures from similar project work obtained from local agency sources.	P
3. Estimate supported by cost guides from independent sources or other federal agencies.	
4. Estimates based upon government wage rates and material cost.	P
5. No cost estimate required – cost charged to Fire Suppression Account.	

P = Personnel Services M = Materials/Supplies T = Travel C = Contract F = Suppression

III. RELEVANT DETAILS, MAPS AND DOCUMENTATION INCLUDED IN THIS REPORT:

List Relevant Documentation and Cross-References Within ESR Plan:

IV. TOTAL COST BY JURISDICTION

JURISDICTION	UNITS TREATED	COST
USFS	70,000 acres	\$360,000
TOTAL COST		\$360,000



BURNED AREA EMERGENCY STABILIZATION & REHABILITATION PLAN

PART F - SPECIFICATION

SPECIFICATION TITLE:	Archaeological POST-TREATMENT MONITORING	JURISDICTIONS:	SJNF
PART E: LINE ITEM:	#26, Archaeological Monitoring	FISCAL YEAR:	2002

I. WORK TO BE DONE

Number and Describe Each Task:

A. General Description:

Monitoring of archaeological sites affected by fire or fire related activities in order to assess the effectiveness of treatment.

B. Location (Suitable) Sites:

SJNF

C. Design/Construction Specifications:

1. An archaeologist will be required to monitor affected archaeological sites monthly for one year.

D. Purpose of Treatment Specifications:

To assess the effectiveness of site rehabilitation as mandated by associated federal legislation

E. Treatment Effectiveness Monitoring:

II. LABOR, MATERIALS AND OTHER COST:

PERSONNEL SERVICES (Grade @ Cost/Hours X # Hours X # Fiscal Years = Cost/Item): Do not include contract personnel costs here (see contractor services below).	COST/ITEM
1 GS-7 archaeologist @ 14.71 x 192 hours =	\$2,824
1 GS-12 archaeologist @ 26.09 x 40 hours =	\$1,044
TOTAL PERSONNEL SERVICE COST	\$3,868
EQUIPMENT PURCHASE, LEASE OR RENTAL (Item @ Cost/Hour or Cost/Day X # Hours or # Days X # Fiscal Years = Cost/Item): (Note: Purchase requires written justification that demonstrates cost/item benefits over lease or rental.)	COST/ITEM
TOTAL EQUIPMENT PURCHASE, LEASE, OR RENTAL COST	\$0
MATERIALS AND SUPPLIES (Item @ Cost/Each X Quantity X # Fiscal Years = Cost/Item):	COST/ITEM
TOTAL MATERIALS AND SUPPLY COST	\$0
TRAVEL COST (Personnel or Equipment @ Rate X Round Trips X # Fiscal Years = Cost/Item):	COST/ITEM
TOTAL TRAVEL COST	\$0



CONTRACT COST (Labor or Equipment @ Cost/Hour X # Hours X # Fiscal Years = Cost/Item):	COST/ITEM
TOTAL CONTRACT COST	\$3,868

SPECIFICATION COST SUMMARY

FISCAL YEAR	UNIT	UNIT COST	# OF UNITS	COST	FUNDING SOURCE	METHOD
FY 1	Archeological Site	\$1,934	2	\$3,868	EFR	P
FY 2						
FY 3						
TOTAL		\$1,934	2	\$3,868		

FUNDING SOURCES:

F = Fire Suppression Account
 EFR=Emergency Fire Rehabilitation
 OP/O =Agency Operating Fund
 EWP = Emergency Watershed Program

SPECIFICATION TYPE

ES = Emergency Stabilization
 R = Rehabilitation
 FS = Fire Suppression

METHODS FOR COMPLETION

P=Agency Personnel Services
 C=Contract
 EFC= Emergency Fire Contract
 FC=Crew Labor Assigned to Fire

SOURCE OF COST ESTIMATE

1. Estimate obtained from 2-3 independent contractual sources.	
2. Documented cost figures from similar project work obtained from local agency sources.	P
3. Estimate supported by cost guides from independent sources or other federal agencies.	
4. Estimates based upon government wage rates and material cost.	P
5. No cost estimate required – cost charged to Fire Suppression Account.	

P = Personnel Services M = Materials/Supplies T = Travel C = Contract F = Suppression

III. RELEVANT DETAILS, MAPS AND DOCUMENTATION INCLUDED IN THIS REPORT:

List Relevant Documentation and Cross-References Within ESR Plan:

IV. TOTAL COST BY JURISDICTION

JURISDICTION	UNITS TREATED	COST
SJNF		\$3,868
TOTAL COST		3,868



BURNED AREA EMERGENCY STABILIZATION & REHABILITATION

PART F - SPECIFICATION

SPECIFICATION TITLE:	Campground/Campsite Safety Assessment	JURISDICTIONS:	
PART E LINE ITEM:	#9, Camping Safety	FISCAL YEAR:	2002

I. WORK TO BE DONE

1. **General Description:**
Conduct eleven campground/campsite safety inventory within the fire area to identify areas that have been negatively impacted by fire effects and pose a threat to public safety and/or watershed integrity. Campgrounds/campsites will be inventoried and assessed prior to use by the public to insure the health and safety of visitors to public lands.
2. **Location (Suitable) Sites:** All campgrounds located within the burned area (11)
3. **Design/Construction Specification(s):**
 1. Field verify the initial work activities described in the BAER request for campground funding.
 2. Identify safety hazards and high erosion potentials in campgrounds that threaten public safety and human health.
 3. Locate, photo document, and map with GPS campgrounds negatively impacted by the fire. Determine stabilization and structural replacement needs.
 4. Prepare and file supplemental funding request for campground related treatments that pose threat to human health and safety and comply with National BAER guidelines.
4. **Purpose of Treatment Specification:** Provide for public safety on public lands through the prompt identification and treatment of short-term fire impacts to campgrounds that pose a threat to human health and safety.

II. LABOR, MATERIALS AND OTHER COST

PERSONNEL SERVICES (Grade @ cost/hour X # hours X fiscal year = cost/item) Do not include contract personnel costs here - see contract services below	COST/ITEM
(Monitoring) SJNF- GS-11 Forest Engineer or Hydrologist @ \$23.53/ Hour x 88 Hours	\$2,071
TOTAL PERSONNEL SERVICE COST	\$2,071
EQUIPMENT PURCHASE, LEASE OR RENTAL (item @ cost/hour or day X #hours or days X fiscal year = cost) Do not include contract personnel costs here -see contract services below	COST/ITEM
TOTAL EQUIPMENT PURCHASE, LEASE, OR RENTAL COST	
MATERIALS AND SUPPLIES (item @ cost/each X quantity x fiscal year = cost)	COST/ITEM
SJNF- 8 rolls of 35 mm film and processing @ \$15/	\$120
TOTAL MATERIALS AND SUPPLY COST	\$120
TRAVEL COST (Personnel @ rate X round trips X fiscal year = cost)	COST/ITEM



TRAVEL COST (Personnel @ rate X round trips X fiscal year = cost)	COST/ITEM
SJNF- 100 miles/ day x 7.5 day s x .35/ mile	\$263
TOTAL MATERIALS AND SUPPLY COST	\$263

CONTRACT COST (Labor, equipment, and travel @ cost/hr. X hrs. X fiscal year = cost)	COST/ITEM
TOTAL CONTRACT COST	

III. SPECIFICATION COST SUMMARY

FISCAL YEAR	UNIT	UNIT COST	# OF UNITS	COST	FUNDING SOURCE	METHOD
FY-1 - SJNF	Surveys	\$223.09	11	\$2,454	ES	P
TOTAL	Surveys	\$223.09	11	\$2,454	ES	P

FUNDING SOURCES:

F = Fire Suppression Account

ESR = Emergency Stabilization & Rehabilitation

OP/O = Agency Operating or Other Account

EWP = Emergency Watershed Protection (NRCS)

SPECIFICATION TYPE

ES = Emergency Stabilization

R = Rehabilitation

FS = Fire Suppression

METHODS FOR COMPLETION:

P = Agency Personnel Services

C = Contract

EFC = Emergency Fire Contract

FC = Crew Labor Assigned to Fire

IV. SOURCE OF COST ESTIMATE

1. Estimate obtained from 2 - 3 independent contractual sources	
2. Documented cost figures from similar project work obtained from local agency resources	
3. Estimate supported by cost guides from independent sources or other federal agencies	P, M, T
4. Estimate based upon government wage rates and materials cost.	
5. No cost estimate required - cost charged to Fire Suppression Account.	

P = Personnel Services

M = Materials/Supplies

T = Travel

C = Contract

F = Fire Suppression

V. RELEVANT DETAILS, MAPS, AND DOCUMENTATION INCLUDED IN REPORT

List relevant documentation and cross-references within ESR Plan: Please refer to Operations Assessment, and Supporting Documentation File.

VI. UNITS AND COSTS BY JURISDICTION

JURISDICTION	UNITS TREATED	COST
San Juan National Forest	11 Surveys	\$2,454
TOTAL COST	11 Surveys	\$2,454



BURNED AREA EMERGENCY STABILIZATION & REHABILITATION PLAN

PART F - SPECIFICATION

SPECIFICATION TITLE:	Damage Assessment and Treatment of Archaeological Sites	JURISDICTIONS:	SJNF
PART E: LINE ITEM:	#10, Damage Assessment	FISCAL YEAR:	2002

I. WORK TO BE DONE

Number and Describe Each Task:

A. General Description:

To assess damages from fire effects and assess the risk of potential storm flood/debris flows upon previously documented cultural resources and identify and assess any unrecorded cultural resources exposed as a result of the Missionary Ridge Complex. Identify and install mitigation treatments to protect sites at risk. The request for funding for treatment in this specification is a preliminary one that will allow for immediate startup on three sites. A supplemental request will be submitted for treatment of those resources identified later in the process.

B. Location (Suitable) Sites:

Sites eligible for assessment are located on SJNF land and private property.

C. Design/Construction Specifications:

1. Damage assessment crews will consist of one GS-7 and two GS-5 archeologists directed by a GS-11 archeologist that will oversee the assessments. The crews will map the site and complete a reevaluation form amended to include potential fire effects.
2. For site 5LP714 one GS-7 archeologist will monitor treatment performed by a rehabilitation crew.

D. Purpose of Treatment Specifications:

To stabilize and prevent unacceptable degradation of critical cultural resources identified as being at hydrologic risk. To meet the legislative mandates of the National Historic Preservation Act, the Archeological Resources Protection Act, and associated federal regulations.

E. Treatment Effectiveness Monitoring:

One GS-7 archeologist to monitor monthly.

II. LABOR, MATERIALS AND OTHER COST:

PERSONNEL SERVICES (Grade @ Cost/Hours X # Hours X # Fiscal Years = Cost/Item): Do not include contract personnel costs here (see contractor services below).	COST/ITEM
Damage Assessment Crews	
1 GS-7 archaeologist @ 18.05/hr x 16 =	\$289
2 GS-5 archaeologists @ 12.80 x 32 =	\$410
1 GS-12 archaeologist @ 26.09 x 80 =	\$2,087
	\$289
Treatment Crew (Monitoring)	
1 GS-7 archaeologist @ 18.05 x 16 =	
TOTAL PERSONNEL SERVICE COST	\$3,075
EQUIPMENT PURCHASE, LEASE OR RENTAL (Item @ Cost/Hour or Cost/Day X # Hours or # Days X # Fiscal Years = Cost/Item): (Note: Purchase requires written justification that demonstrates cost/item benefits over lease or rental.)	COST/ITEM
TOTAL EQUIPMENT PURCHASE, LEASE, OR RENTAL COST	\$0



MATERIALS AND SUPPLIES (Item @ Cost/Each X Quantity X # Fiscal Years = Cost/Item):	COST/ITEM
5 rolls of film (purchase and processing)	\$75
TOTAL MATERIALS AND SUPPLY COST	\$75
TRAVEL COST (Personnel or Equipment @ Rate X Round Trips X # Fiscal Years = Cost/Item):	COST/ITEM
TOTAL TRAVEL COST	\$0
CONTRACT COST (Labor or Equipment @ Cost/Hour X # Hours X # Fiscal Years = Cost/Item):	COST/ITEM
TOTAL CONTRACT COST	\$3,150

SPECIFICATION COST SUMMARY

FISCAL YEAR	UNIT	UNIT COST	# OF UNITS	COST	FUNDING SOURCE	METHOD
FY 1	Archaeologica Site	\$1,575	2	\$3,150	EFR	P
FY 2						
FY 3						
TOTAL		\$1,575	2	\$3,150		

FUNDING SOURCES:

F = Fire Suppression Account
 EFR=Emergency Fire Rehabilitation
 OP/O =Agency Operating Fund
 EWP = Emergency Watershed Program

SPECIFICATION TYPE

ES = Emergency Stabilization
 R = Rehabilitation
 FS = Fire Suppression

METHODS FOR COMPLETION

P=Agency Personnel Services
 C=Contract
 EFC= Emergency Fire Contract
 FC=Crew Labor Assigned to Fire

SOURCE OF COST ESTIMATE

1. Estimate obtained from 2-3 independent contractual sources.	
2. Documented cost figures from similar project work obtained from local agency sources.	P
3. Estimate supported by cost guides from independent sources or other federal agencies.	
4. Estimates based upon government wage rates and material cost.	P, M
5. No cost estimate required – cost charged to Fire Suppression Account.	

P = Personnel Services M = Materials/Supplies T = Travel C = Contract F = Suppression

III. RELEVANT DETAILS, MAPS AND DOCUMENTATION INCLUDED IN THIS REPORT:

List Relevant Documentation and Cross-References Within ESR Plan:

BURNED AREA EMERGENCY STABILIZATION & REHABILITATION PLAN

PART F - SPECIFICATION

SPECIFICATION TITLE:	NATIVE AMERICAN CONSULTATION	JURISDICTIONS:	SJNF
PART E: LINE ITEM:	#24, Native American Consultation	FISCAL YEAR:	2002, 2003

I. WORK TO BE DONE

Number and Describe Each Task:

A. General Description:

Consultation with pertinent Native American tribal representatives regarding the Missionary Ridge Complex cultural resource damage assessment strategy, results of assessment, and proposed monitoring and mitigation measures.

B. Location (Suitable) Sites:

San Juan Public Lands Center or at the appropriate site

C. Design/Construction Specifications:

1. Consultation will be conducted twice annually with an estimated 5 tribal representatives - at the beginning of the assessment process and again once mitigative measures are to begin.

D. Purpose of Treatment Specifications:

Consultation is mandated by the National Historic Preservation Act, the Archaeological Resources Protection Act, the American Indian Religious Freedom Act, the Native American Graves Protection and Repatriation Act, and associated federal legislation. These consultations will allow Native American representatives to have input into the planning process for the treatments proposed for archaeological sites in the burn area.

E. Treatment Effectiveness Monitoring:

II. LABOR, MATERIALS AND OTHER COST:

PERSONNEL SERVICES (Grade @ Cost/Hours X # Hours X # Fiscal Years = Cost/Item): Do not include contract personnel costs here (see contractor services below).	COST/ITEM
1 GS-12 archaeologist @ 26.09 x 16/hours =	\$417
TOTAL PERSONNEL SERVICE COST	\$417
EQUIPMENT PURCHASE, LEASE OR RENTAL (Item @ Cost/Hour or Cost/Day X # Hours or # Days X # Fiscal Years = Cost/Item): (Note: Purchase requires written justification that demonstrates cost/item benefits over lease or rental.)	COST/ITEM
TOTAL EQUIPMENT PURCHASE, LEASE, OR RENTAL COST	\$0
MATERIALS AND SUPPLIES (Item @ Cost/Each X Quantity X # Fiscal Years = Cost/Item):	COST/ITEM
TOTAL MATERIALS AND SUPPLY COST	\$0
TRAVEL COST (Personnel or Equipment @ Rate X Round Trips X # Fiscal Years = Cost/Item):	COST/ITEM
TOTAL TRAVEL COST	\$0



CONTRACT COST (Labor or Equipment @ Cost/Hour X # Hours X # Fiscal Years = Cost/Item):	COST/ITEM
5 Tribal Representatives @ \$500 ea. x 2 semi-annual meetings	\$5,000
TOTAL CONTRACT COST	\$5,000

SPECIFICATION COST SUMMARY

FISCAL YEAR	UNIT	UNIT COST	# OF UNITS	COST	FUNDING SOURCE	METHOD
FY 1	Person	\$500	10	\$5,000	EFR	C
FY 2						
FY 3						
TOTAL		\$0		\$0		

FUNDING SOURCES:

F = Fire Suppression Account

EFR=Emergency Fire Rehabilitation

OP/O =Agency Operating Fund

EWP = Emergency Watershed Program

SPECIFICATION TYPE

ES = Emergency Stabilization

R = Rehabilitation

FS = Fire Suppression

METHODS FOR COMPLETION

P=Agency Personnel Services

C=Contract

EFC= Emergency Fire Contract

FC=Crew Labor Assigned to Fire

SOURCE OF COST ESTIMATE

1. Estimate obtained from 2-3 independent contractual sources.	
2. Documented cost figures from similar project work obtained from local agency sources.	C
3. Estimate supported by cost guides from independent sources or other federal agencies.	
4. Estimates based upon government wage rates and material cost.	
5. No cost estimate required – cost charged to Fire Suppression Account.	

P = Personnel Services M = Materials/Supplies T = Travel C = Contract F = Suppression

III. RELEVANT DETAILS, MAPS AND DOCUMENTATION INCLUDED IN THIS REPORT:

List Relevant Documentation and Cross-References Within ESR Plan:

IV. TOTAL COST BY JURISDICTION

JURISDICTION	UNITS TREATED	COST
SJNF		\$5,000



BURNED AREA EMERGENCY STABILIZATION & REHABILITATION PLAN

PART F - SPECIFICATION

SPECIFICATION TITLE:	Trail Safety Assessment and Monitoring	JURISDICTIONS:	USFS
PART E: LINE ITEM:	#25, Trail Safety	FISCAL YEAR:	2002

I. WORK TO BE DONE

Number and Describe Each Task:

A. General Description:

Conduct trail safety inventory along trail systems within the fire area to identify areas that have been negatively impacted by fire effects and pose a threat to public safety and/or watershed integrity. Trails will be inventoried and assessed prior to use by the public to insure the health and safety of visitors to public lands. Develop a monitoring plan for application throughout the recovery period. Minimum of 3 years.

B. Location (Suitable) Sites:

All trails within the burned area that will be re-opened. Reference Post Burn Trail Inventory Spread Sheet.

C. Design/Construction Specifications:

1. Field verify the initial work activities described in the BAER request for trail funding.
2. Identify safety hazards and high erosion potentials along major trail systems that threaten public safety and human health.
3. Locate, photo document, and map with GPS trail structures negatively impacted by the fire including drainage structures, wooden steps, bank stabilization structures (log or rock), and loss of trail tread that will erode or require stabilization treatment. Map erodible sites that will contribute to trail failure and watershed instability.
4. Determine stabilization and structural replacement needs.
5. Prepare and file supplemental funding request for stabilization treatments that pose threat to human health and safety and comply with National BAER guidelines.
6. Develop a formal monitoring in addition to the normal work monitoring that takes place in normal work programs.

D. Purpose of Treatment Specifications:

To identify work activities that need to be corrected to insure safe use of the trail for employees, outfitters, and recreationists.

E. Treatment Effectiveness Monitoring:

Monitoring will be accomplished by trail specialists and staffs.

II. LABOR, MATERIALS AND OTHER COSTS:

PERSONAL SERVICES	Cost/Hour	# of Hours	COST/ITEM
Do not include contract personnel costs here			
GS-11	\$25.00	180	\$4,500.00
GS-11 TRAIL ENGINEER/HYDRO	\$25.00	180	\$4,500.00
Monitoring Team - GS 13 Staff	\$44.00	30	\$1,320.00
- GS 12 Soil Scientist	\$42.00	80	\$3,360.00
- GS 12 Hydrologist	\$42.00	100	\$4,200.00
- GS 11 Engineer	\$36.00	46	\$1,656.00
- GS 11 Rec Staff	\$25.00	155	\$3,875.00
			\$0.00
			\$0.00
			\$0.00
			\$0.00
			\$0.00
			\$0.00
TOTAL PERSONNEL SERVICE COST			\$23,411.00



MATERIALS AND SUPPLIES	Cost Each	Quantity	COST/ITEM
FILM AND PROCESSING	\$15.00	12	\$180.00
			\$0.00
			\$0.00
			\$0.00
			\$0.00
			\$0.00
TOTAL MATERIALS AND SUPPLIES COST			\$180.00

TRAVEL COST	Cost/Hour	# of Hours	COST/ITEM
40 MILES*100 DAYS*0.35/MILE			\$1,400.00
			\$0.00
			\$0.00
			\$0.00
			\$0.00
TOTAL TRAVEL COST			\$1,400.00

TOTAL COST BY JURISDICTION	UNITS TREATED	COST
USFS	12	\$24,991.00
TOTAL COST		\$24,991.00

SPECIFICATION COST SUMMARY

FISCAL YEAR	UNIT	UNIT COST	# OF UNITS	COST	FUNDING SOURCE	METHOD
FY 1	TRAIL	\$2082	12	\$24,991	ES	
FY 2						
FY 3						
TOTAL		\$0		\$24,991		

FUNDING SOURCES:

F = Fire Suppression Account
 EFR=Emergency Fire Rehabilitation
 OP/O =Agency Operating Fund
 EWP = Emergency Watershed Program

SPECIFICATION TYPE

ES = Emergency Stabilization
 R = Rehabilitation
 FS = Fire Suppression

METHODS FOR COMPLETION

P=Agency Personnel Services
 C=Contract
 EFC= Emergency Fire Contract
 FC=Crew Labor Assigned to Fire



SOURCE OF COST ESTIMATE

1. Estimate obtained from 2-3 independent contractual sources.	
2. Documented cost figures from similar project work obtained from local agency sources.	
3. Estimate supported by cost guides from independent sources or other federal agencies.	PMT
4. Estimates based upon government wage rates and material cost.	
5. No cost estimate required – cost charged to Fire Suppression Account.	

P = Personnel Services M = Materials/Supplies T = Travel C = Contract F = Suppression

III. RELEVANT DETAILS, MAPS AND DOCUMENTATION INCLUDED IN THIS REPORT:

List Relevant Documentation and Cross-References Within ESR Plan:

APPENDIX I – ROAD AND TRAILS ASSESSMENT



PART F - SPECIFICATION

I. WORK TO BE DONE

A. General Description:

Replace road signs burned or damaged by the fire to provide for public safety

B. Location (Suitable) Sites:

Reference Road Condition Survey

C. Design/Construction Specifications:

1. Implement sign construction and replacement operations in accordance with Agency standards and policies.
2. Replace and repair regulatory, area closure, and public safety signs and initiate repair to minor facilities immediately to provide for public safety.

D. Purpose of Treatment Specifications:

Provide for public safety on public lands through the prompt replacement of signs,

E. Treatment Effectiveness Monitoring:

Signs and road conditions will be monitored by FS employees and road maintenance crews to insure effectiveness.

PERSONAL SERVICES			
Do not include contract personnel costs here	Cost/Hour	# of Hours	COST/ITEM
GS-9	\$25.00	40	\$1,000.00
WG-5	\$15.00	80	\$1,200.00
			\$0.00
			\$0.00
			\$0.00
			\$0.00
			\$0.00
			\$0.00
			\$0.00
			\$0.00
			\$0.00
			\$0.00
			\$0.00
TOTAL PERSONNEL SERVICE COST			\$2,200.00



MATERIALS AND SUPPLIES	Cost Each	Quantity	COST/ITEM
SIGNS AND POSTS	\$150.00	25	\$3,750.00
			\$0.00
			\$0.00
			\$0.00
			\$0.00
			\$0.00
TOTAL MATERIALS AND SUPPLIES COST			\$3,750.00

TOTAL COST BY JURISDICTION	UNITS TREATED	COST
USFS	25	\$5,950.00
TOTAL COST		\$5,950.00

SPECIFICATION COST SUMMARY

FISCAL YEAR	UNIT	UNIT COST	# OF UNITS	COST	FUNDING SOURCE	METHOD
FY 2002	EACH	238	25	\$5,950	EFR	P
FY 2						
FY 3						
TOTAL		\$0		\$5,950		

FUNDING SOURCES:

F = Fire Suppression Account
 EFR=Emergency Fire Rehabilitation
 OP/O =Agency Operating Fund
 EWP = Emergency Watershed Program

SPECIFICATION TYPE

ES = Emergency Stabilization
 R = Rehabilitation
 FS = Fire Suppression

METHODS FOR COMPLETION

P=Agency Personnel Services
 C=Contract
 EFC= Emergency Fire Contract
 FC=Crew Labor Assigned to Fire

**SOURCE OF COST ESTIMATE**

1. Estimate obtained from 2-3 independent contractual sources.	
2. Documented cost figures from similar project work obtained from local agency sources.	
3. Estimate supported by cost guides from independent sources or other federal agencies.	P,M
4. Estimates based upon government wage rates and material cost.	
5. No cost estimate required – cost charged to Fire Suppression Account.	

P = Personnel Services M = Materials/Supplies T = Travel C = Contract F = Suppression

III. RELEVANT DETAILS, MAPS AND DOCUMENTATION INCLUDED IN THIS REPORT:

List Relevant Documentation and Cross-References Within ESR Plan:

Specifications





BURNED AREA EMERGENCY STABILIZATION & REHABILITATION PLAN

PART F - SPECIFICATION

SPECIFICATION TITLE:	Warning Signs Roads and Trails	JURISDICTIONS:	USFS
PART E: LINE ITEM:	#15, Warning signs	FISCAL YEAR:	2002

I. WORK TO BE DONE

Number and Describe Each Task:

A. General Description:

This treatment will be used to advise road users of the presence of a burned watershed and associated safety issues. Suggested wording: WARNING BURNED WATERSHED NEXT 1 MILE – Risk from Flash Floods, Rockfall and Debris Flows.

B. Location (Suitable) Sites:

On maintenance level 3 and above roads and trails at the entrance to the burn and below burned watersheds. Road 682 & 683, and at other locations to be determined by the Forest. Signs could also be installed on state and county roads entering and below the burned area.

C. Design/Construction Specifications:

1. Warning signs will be black on yellow background and Engineer grade reflective.
2. Meet MUTCD standards.
3. Letters sized to meet design speed of road.
4. All work shall be in accordance with Section 633 Signs, USDA-FS EM 7720-100 1996.

D. Purpose of Treatment Specifications:

This treatment is intended to advise road users of the presence of a burned watershed and some of the associated safety issues.

E. Treatment Effectiveness Monitoring:

Monitoring will be accomplished by FS employees and road maintenance crews.

II. LABOR, MATERIALS AND OTHER COSTS:

Do not include contract personnel costs here	Cost/Hour	# of Hours	COST/ITEM
WG-5, Roads	\$15.00	100	\$1,500.00
GS-9, Roads	\$25.00	40	\$1,000.00
GS-5, Trails	\$13.00	200	\$2,600.00
GS-5, Admin - Trails	\$13.00	40	\$520.00
			\$0.00
			\$0.00
			\$0.00
			\$0.00
			\$0.00
			\$0.00
			\$0.00
			\$0.00
			\$0.00
TOTAL PERSONNEL SERVICE COST			\$5,620.00



MATERIALS AND SUPPLIES	Cost Each	Quantity	COST/ITEM
SIGNS, Roads	\$600.00	10	\$6,000.00
Signs, Trails	\$50.00	50	\$2,500.00
			\$0.00
			\$0.00
			\$0.00
			\$0.00
TOTAL MATERIALS AND SUPPLIES COST			\$8,500.00

TRAVEL COST	Cost/Hour	# of Hours	COST/ITEM
Travel, Roads			\$500.00
Travel, Trails			\$500.00
			\$0.00
			\$0.00
			\$0.00
TOTAL TRAVEL COST			\$1,000.00

CONTRACT COST	Cost/Hour	# of Hours	COST/ITEM
Contract, Trails			\$5,970.00
			\$0.00
			\$0.00
			\$0.00
			\$0.00
TOTAL CONTRACT COST			\$5,970.00

TOTAL COST BY JURISDICTION	UNITS TREATED	COST
USFS - Roads	10	\$9,000.00
USFS - Trails	50	\$12,090.00
TOTAL COST		\$21,090.00



SOURCE OF COST ESTIMATE

1. Estimate obtained from 2-3 independent contractual sources.	
2. Documented cost figures from similar project work obtained from local agency sources.	
3. Estimate supported by cost guides from independent sources or other federal agencies.	P,M,T
4. Estimates based upon government wage rates and material cost.	
5. No cost estimate required – cost charged to Fire Suppression Account.	

P = Personnel Services **M** = Materials/Supplies **T** = Travel **C** = Contract **F** = Suppression

III. RELEVANT DETAILS, MAPS AND DOCUMENTATION INCLUDED IN THIS REPORT:

List Relevant Documentation and Cross-References Within ESR Plan: See Appendix I, Roads and Trains Assessment.



BURNED AREA EMERGENCY STABILIZATION & REHABILITATION PLAN

PART F - SPECIFICATION

SPECIFICATION TITLE:	Trail Sign Replacement	JURISDICTIONS:	USFS
PART E: LINE ITEM:	#18, T-3, Trail Sign Replacement	FISCAL YEAR:	?
ESR REFERENCE#		SPECIFICATION TYPE:	

I. WORK TO BE DONE

Number and Describe Each Task:

A. General Description:

Replace trail signs burned or damaged by the fire to provide for public safety.

B. Location (Suitable) Sites:

See trail inventory spread sheet. Locations will be determined after from an on the ground safety assessment.

C. Design/Construction Specifications:

1. Implement sign construction and replacement operations in accordance with Agency standards and policies.
2. Replace and repair regulatory, and public safety signs and initiate repair to minor facilities immediately to provide for public safety.

D. Purpose of Treatment Specifications:

Provide for public safety on public lands through the prompt replacement of signs.

E. Treatment Effectiveness Monitoring:

Monitoring will be accomplished by trail and recreation crews.

II. LABOR, MATERIALS AND OTHER COSTS:

PERSONAL SERVICES	Cost/Hour	# of Hours	COST/ITEM
Do not include contract personnel costs here			
GS-5 REC TECH	\$13.00	64	\$832.00
			\$0.00
			\$0.00
			\$0.00
			\$0.00
			\$0.00
			\$0.00
			\$0.00
			\$0.00
			\$0.00
			\$0.00
			\$0.00
			\$0.00
TOTAL PERSONNEL SERVICE COST			\$832.00



MATERIALS AND SUPPLIES	Cost Each	Quantity	COST/ITEM
POST AND SIGN	\$100.00	8	\$800.00
			\$0.00
			\$0.00
			\$0.00
			\$0.00
			\$0.00
TOTAL MATERIALS AND SUPPLIES COST			\$800.00

TRAVEL COST	Cost/Hour	# of Hours	COST/ITEM
40 MI*8 DAYS*.35			\$112.00
			\$0.00
			\$0.00
			\$0.00
			\$0.00
TOTAL TRAVEL COST			\$112.00

TOTAL COST BY JURISDICTION	UNITS TREATED	COST
USFS		\$1,744.00
TOTAL COST		\$1,744.00



SPECIFICATION COST SUMMARY

FISCAL YEAR	UNIT	UNIT COST	# OF UNITS	COST	FUNDING SOURCE	METHOD
FY 1	EA	218	8	\$1,744		
FY 2						
FY 3						
TOTAL		\$0		\$1,744		

FUNDING SOURCES:

F = Fire Suppression Account

EFR=Emergency Fire Rehabilitation

OP/O =Agency Operating Fund

EWP = Emergency Watershed Program

SPECIFICATION TYPE

ES = Emergency Stabilization

R = Rehabilitation

FS = Fire Suppression

METHODS FOR COMPLETION

P=Agency Personnel Services

C=Contract

EFC= Emergency Fire Contract

FC=Crew Labor Assigned to Fire

SOURCE OF COST ESTIMATE

1. Estimate obtained from 2-3 independent contractual sources.	
2. Documented cost figures from similar project work obtained from local agency sources.	
3. Estimate supported by cost guides from independent sources or other federal agencies.	
4. Estimates based upon government wage rates and material cost.	PMT
5. No cost estimate required -- cost charged to Fire Suppression Account.	

P = Personnel Services M = Materials/Supplies T = Travel C = Contract F = Suppression

III. RELEVANT DETAILS, MAPS AND DOCUMENTATION INCLUDED IN THIS REPORT:

List Relevant Documentation and Cross-References Within ESR Plan:

SEE APPENDIX I, ROADS AND TRAILS ASSESSMENT





BURNED AREA EMERGENCY STABILIZATION & REHABILITATION PLAN

PART F - SPECIFICATION

SPECIFICATION TITLE:	Grade Dips	JURISDICTIONS:	USFS
PART E: LINE ITEM:	#13, Grade Dips	FISCAL YEAR:	2002, 2003

I. WORK TO BE DONE

Number and Describe Each Task:

A. General Description:

Construct grade dips to improve road drainage and to accommodate increased flows resulting from post-burn watershed conditions. This treatment applies to maintenance level 2, 3 and 4 roads. Grade dips associated with cross drains and culverts are armored.

B. Location (Suitable) Sites:

On level 2, 3 and 4 roads within and downstream of the burned area. See road survey logs and treatment map for locations.

C. Design/Construction Specifications:

1. Construct grade dips in accordance with details shown on attached drawing.
2. Standard length is approximately 80 feet, depending on slope.
3. Approximate skew is 30 degrees to drain over armored fill.
4. Locations of the drainage dips shall be as staked in the field by the engineer.
5. Outlets of dips will be armored with rip rap over the fill to natural ground.
6. Traveled way will be reinforced with 4 inches of road base to prevent rutting.
7. Riprap and road base will be "walked in" with heavy equipment.
8. All work shall be in accordance with Section 203 Excavation, Embankment, and Haul, and Section 304 Aggregate Base & Surfacing Course, USDA-FS EM 7720-100 1996.

D. Purpose of Treatment Specifications:

To drain water from road surfaces and to allow predicted storm water to flow across the road rather than down the road. This will minimize potential gully erosion and stream capture.

E. Treatment Effectiveness Monitoring:

Grade dips will continue to be monitored by Forest Service Personnel as other work activities are conducted.

II. LABOR, MATERIALS AND OTHER COSTS:

PERSONAL SERVICES	Cost/Hour	# of Hours	COST/ITEM
Do not include contract personnel costs here			
GS-13	\$44.00	16	\$704.00
GS-12	\$42.50	100	\$4,250.00
GS-11	\$36.00	200	\$7,200.00
GS-9	\$25.00	280	\$7,000.00
GS-7	\$23.00	120	\$2,760.00
GS-4	\$12.50	80	\$1,000.00
			\$0.00
			\$0.00
			\$0.00
			\$0.00
			\$0.00
			\$0.00
			\$0.00
TOTAL PERSONNEL SERVICE COST			\$22,914.00



EQUIPMENT PURCHASE, LEASE OR RENTAL	Cost/Day- Cost/Hour	# of Days- # of Hours	COST/ITEM
*Purchase requires written justification			
VEHICLE FOR	\$7.50	30	\$225.00
VEHICLE MILEAGE	\$0.25	1000	\$250.00
			\$0.00
			\$0.00
			\$0.00
			\$0.00
TOTAL EQUIPMENT PURCH, LEASE, RENT COST			\$475.00

MATERIALS AND SUPPLIES	Cost Each	Quantity	COST/ITEM
MISC. SUPPLIES	\$1,000.00	1	\$1,000.00
			\$0.00
			\$0.00
			\$0.00
			\$0.00
			\$0.00
TOTAL MATERIALS AND SUPPLIES COST			\$1,000.00

TRAVEL COST	Cost/Hour	# of Hours	COST/ITEM
MISC TRAVEL	\$50.00	16	\$800.00
			\$0.00
			\$0.00
			\$0.00
			\$0.00
TOTAL TRAVEL COST			\$800.00

CONTRACT COST	Cost/Hour	# of Hours	COST/ITEM
Grade Dips, FSR 682, large CMP locations	\$2,825.00	5	\$14,125.00
Grade Dips, FSR 682, Missionary Ridge	\$2,825.00	15	\$42,375.00
Grade Dips, FSR 602, Pine River	\$2,825.00	15	\$42,375.00
Grade Dips, FSR 071, Baldy Mountain	\$2,825.00	30	\$84,750.00
Contract Administration - 10% total contract			\$18,362.50
Grade Dips, 809 - 10ea, 083-8ea, 802-3ea, 852-9ea	\$30.00	250	\$7,500.00
TOTAL CONTRACT COST			\$209,487.50



TOTAL COST BY JURISDICTION	UNITS TREATED	COST
US Forest Service	65	\$234,677.00
TOTAL COST		\$234,677.00

SPECIFICATION COST SUMMARY

FISCAL YEAR	UNIT	UNIT COST	# OF UNITS	COST	FUNDING SOURCE	METHOD
FY 1	Each	\$2011	65	\$130,695	EFR	P, C
FY 2	Each	\$3,465	30	\$103,982	EFR	P, C
FY 3						
TOTAL		\$6,926	65	\$234,677	EFR	C

FUNDING SOURCES:

F = Fire Suppression Account
 EFR=Emergency Fire Rehabilitation
 OP/O =Agency Operating Fund
 EWP = Emergency Watershed Program

SPECIFICATION TYPE

ES = Emergency Stabilization
 R = Rehabilitation
 FS = Fire Suppression

METHODS FOR COMPLETION

P=Agency Personnel Services
 C=Contract
 EFC= Emergency Fire Contract
 FC=Crew Labor Assigned to Fire

SOURCE OF COST ESTIMATE

1. Estimate obtained from 2-3 independent contractual sources.	
2. Documented cost figures from similar project work obtained from local agency sources.	C, M, T
3. Estimate supported by cost guides from independent sources or other federal agencies.	C
4. Estimates based upon government wage rates and material cost.	P
5. No cost estimate required – cost charged to Fire Suppression Account.	

P = Personnel Services M = Materials/Supplies T = Travel C = Contract F = Suppression

III. RELEVANT DETAILS, MAPS AND DOCUMENTATION INCLUDED IN THIS REPORT:

List Relevant Documentation and Cross-References Within ESR Plan: See Appendix I, Roads and Trails Assessment



BURNED AREA EMERGENCY STABILIZATION & REHABILITATION PLAN

PART F - SPECIFICATION

SPECIFICATION TITLE:	Culvert replacement in ephemeral or intermittent drainage	JURISDICTIONS:	USFS
PART E: LINE ITEM:	#11, Culvert Replacement	FISCAL YEAR:	2002, 2003

I. WORK TO BE DONE

Number and Describe Each Task:

A. General Description:

Remove existing (mostly 18 inch) culverts and replace with larger pipes, where warranted (Generally 24 inch).

B. Location (Suitable) Sites:

On Level 3 and above roads with and downstream of the burn area on Missionary Ridge. (Refer to Road Condition Survey)

C. Design/Construction Specifications:

1. Remove existing 18" CMP and fill material to natural stream gradient.
2. Install new CMP with flared inlet (metal end section) on natural stream gradient
3. Place excess fill material in suitable areas where it will not be delivered to the stream channel.
4. armor all inlets and outlets with riprap.
5. Field verify lengths before ordering culvert pipe.
6. All culverts will be installed in accordance with USDA-FS EM 7720-100 1996, Sections 203 Excavation, Embankment, Haul; 251 Riprap; 304 Aggregate Base and Surface Course; 603 Metal Pipe

D. Purpose of Treatment Specifications:

Increasing culverts will assure passage of water and sediment for predicted storm flows. Larger culverts will also minimize potential for debris clogging and stream capture.

E. Treatment Effectiveness Monitoring:

Culverts will be monitored to determine the effectiveness of the installations and to insure that drainage is working properly.

II. LABOR, MATERIALS AND OTHER COSTS:

PERSONAL SERVICES	Cost/Hour	# of Hours	COST/ITEM
Do not include contract personnel costs here			
GS-13	\$44.00	16	\$704.00
GS-12	\$42.50	48	\$2,040.00
GS-11	\$36.00	160	\$5,760.00
GS-9	\$25.00	120	\$3,000.00
GS-7	\$23.00	80	\$1,840.00
GS-4	\$12.50	40	\$500.00
			\$0.00
			\$0.00
			\$0.00
			\$0.00
			\$0.00
			\$0.00
			\$0.00
TOTAL PERSONNEL SERVICE COST			\$13,844.00



EQUIPMENT PURCHASE, LEASE OR RENTAL	Cost/Day- Cost/Hour	# of Days- # of Hours	COST/ITEM
*Purchase requires written justification			
Vehicle FOR	\$7.50	30	\$225.00
Vehicle Mileage	\$0.25	1000	\$250.00
			\$0.00
			\$0.00
			\$0.00
			\$0.00
TOTAL EQUIPMENT PURCH, LEASE, RENT COST			\$475.00

MATERIALS AND SUPPLIES	Cost Each	Quantity	COST/ITEM
Misc. Supplies	\$500.00	1	\$500.00
			\$0.00
			\$0.00
			\$0.00
			\$0.00
			\$0.00
TOTAL MATERIALS AND SUPPLIES COST			\$500.00

TRAVEL COST	Cost/Hour	# of Hours	COST/ITEM
Misc. Travel	\$50.00	8	\$400.00
			\$0.00
			\$0.00
			\$0.00
			\$0.00
TOTAL TRAVEL COST			\$400.00

CONTRACT COST	Cost/Item	# of Items	COST/ITEM
FSR #682, Missionary Ridge Culverts - Total 31	\$3,570.00	31	\$110,670.00
FSR #602, Pine River Road Culverts, Total 30	\$3,570.00	30	\$107,100.00
Contract Administration - 10% of total contract			\$21,777.00
			\$0.00
			\$0.00
TOTAL CONTRACT COST			\$239,547

TOTAL COST BY JURISDICTION	UNITS TREATED	COST
US Forest Service	61	\$254,766
TOTAL COST		\$254,766



SPECIFICATION COST SUMMARY

FISCAL YEAR	UNIT	UNIT COST	# OF UNITS	COST	FUNDING SOURCE	METHOD
FY 2002	Each	\$4,176	31	\$129,471	EFR	P, C
FY 2003	Each	\$4,176	30	\$125,295	EFR	P, C
FY 3						
TOTAL		\$4,176	61	\$254,766	EFR	C

FUNDING SOURCES:

F = Fire Suppression Account
 EFR=Emergency Fire Rehabilitation
 OP/O =Agency Operating Fund
 EWP = Emergency Watershed Program

SPECIFICATION TYPE

ES = Emergency Stabilization
 R = Rehabilitation
 FS = Fire Suppression

METHODS FOR COMPLETION

P=Agency Personnel Services
 C=Contract
 EFC= Emergency Fire Contract
 FC=Crew Labor Assigned to Fire

SOURCE OF COST ESTIMATE

1. Estimate obtained from 2-3 independent contractual sources.	
2. Documented cost figures from similar project work obtained from local agency sources.	C, M, T
3. Estimate supported by cost guides from independent sources or other federal agencies.	C
4. Estimates based upon government wage rates and material cost.	P
5. No cost estimate required – cost charged to Fire Suppression Account.	

P = Personnel Services M = Materials/Supplies T = Travel C = Contract F = Suppression

III. RELEVANT DETAILS, MAPS AND DOCUMENTATION INCLUDED IN THIS REPORT:**List Relevant Documentation and Cross-References Within ESR Plan:**

See Appendix I Roads and Trails Assessment.



BURNED AREA EMERGENCY STABILIZATION & REHABILITATION PLAN

PART F - SPECIFICATION

SPECIFICATION TITLE:	Culvert Replacement (perennial) stream	JURISDICTIONS:	USFS
PART E: LINE ITEM:	#12, Culvert Replacement	FISCAL YEAR:	2002, 2003

I. WORK TO BE DONE

Number and Describe Each Task:

A. General Description:

Remove existing culverts and replace with larger pipes.

B. Location (Suitable) Sites:

On maintenance level 3 and 4 roads at locations within or below the burned area. (Refer to Road Condition Inventory)

C. Design/Construction Specifications:

1. Remove existing culvert and fill material to natural stream gradient.
2. Install new metal pipe arches with flared inlet (metal end section) on natural stream gradient
3. Install new metal pipe arches to provide fish passage by burying bottom 6 inches into channel to create a natural bottom.
4. Place excess fill material in suitable areas where it will not be delivered to the stream channel.
5. Armor inlets with riprap.
6. Field verify lengths before ordering culvert pipe.
7. All culverts will be installed in accordance with USDA-FS EM 7720-100 1996, Sections 203 Excavation, Embankment, Haul; 251 Riprap; 304 Aggregate Base and Surface Course; 603 Metal Pipe

D. Purpose of Treatment Specifications:

Increasing culverts will assure passage of water and sediment for predicted storm flows. Larger culverts will also minimize potential for debris clogging and stream capture.

E. Treatment Effectiveness Monitoring:

Major crossings will be monitored continually throughout the year by FS employees and road maintenance crews.

II. LABOR, MATERIALS AND OTHER COSTS:

PERSONAL SERVICES	Cost/Hour	# of Hours	COST/ITEM
Do not include contract personnel costs here			
GS-13	\$44.00	16	\$704.00
GS-12	\$42.50	160	\$6,800.00
GS-11	\$36.00	200	\$7,200.00
GS-9	\$25.00	200	\$5,000.00
GS-7	\$23.00	80	\$1,840.00
GS-4	\$12.50	80	\$1,000.00
			\$0.00
			\$0.00
			\$0.00
			\$0.00
			\$0.00
			\$0.00
			\$0.00
TOTAL PERSONNEL SERVICE COST			\$22,544.00



EQUIPMENT PURCHASE, LEASE OR RENTAL	Cost/Day- Cost/Hour	# of Days- # of Hours	COST/ITEM
*Purchase requires written justification			
Vehicle FOR	\$7.50	90	\$675.00
Vehicle Mileage	\$0.25	3000	\$750.00
			\$0.00
			\$0.00
			\$0.00
			\$0.00
TOTAL EQUIPMENT PURCH, LEASE, RENT COST			\$1,425.00

MATERIALS AND SUPPLIES	Cost Each	Quantity	COST/ITEM
Misc. Supplies	\$2,500.00	1	\$2,500.00
			\$0.00
			\$0.00
			\$0.00
			\$0.00
			\$0.00
TOTAL MATERIALS AND SUPPLIES COST			\$2,500.00

TRAVEL COST	Cost/Hour	# of Hours	COST/ITEM
Misc. Travel	\$50.00	40	\$2,000.00
			\$0.00
			\$0.00
			\$0.00
			\$0.00
TOTAL TRAVEL COST			\$2,000.00

CONTRACT COST	Cost/Hour	# of Hours	COST/ITEM
Culvert Removal and Replacement, Pretty Creek, 72 inch CSP	\$20,573.00	1	\$20,573.00
Culvert Removal and Replacement, Unknown Drainage, 72 inch CSP	\$20,422.00	1	\$20,422.00
Culvert Removal and Replacement, North Fork Coon Creek, 72 inch CSP	\$20,573.00	1	\$20,573.00
Culvert Removal and replacement with two pipe arches, South Fork Coon Creek	\$37,841.00	1	\$37,841.00
Culvert Removal and Replacement with pipe arch, Middle Fork of Coon Creek	\$27,676.00	1	\$27,676.00
Contract Administration - 10% contract cost			\$12,708.50



TOTAL COST BY JURISDICTION	UNITS TREATED	COST
USFS	5	168,263
TOTAL COST		168,263

SPECIFICATION COST SUMMARY

FISCAL YEAR	UNIT	UNIT COST	# OF UNITS	COST	FUNDING SOURCE	METHOD
FY 1	EACH	\$29,653	5	\$148,263	EFR	P, C
FY 2	LS	\$20,000	1	\$20,000	EFR	P
FY 3						
TOTAL		\$0	5	\$168,263	EFR	P, C

FUNDING SOURCES:

F = Fire Suppression Account

EFR=Emergency Fire Rehabilitation

OP/O =Agency Operating Fund

EWP = Emergency Watershed Program

SPECIFICATION TYPE

ES = Emergency Stabilization

R = Rehabilitation

FS = Fire Suppression

METHODS FOR COMPLETION

P=Agency Personnel Services

C=Contract

EFC= Emergency Fire Contract

FC=Crew Labor Assigned to Fire

SOURCE OF COST ESTIMATE

1. Estimate obtained from 2-3 independent contractual sources.	C
2. Documented cost figures from similar project work obtained from local agency sources.	C
3. Estimate supported by cost guides from independent sources or other federal agencies.	C, M, T
4. Estimates based upon government wage rates and material cost.	P, C
5. No cost estimate required – cost charged to Fire Suppression Account.	

P = Personnel Services M = Materials/Supplies T = Travel C = Contract F = Suppression

III. RELEVANT DETAILS, MAPS AND DOCUMENTATION INCLUDED IN THIS REPORT:

List Relevant Documentation and Cross-References Within ESR Plan:

SEE APPENDIX I, ROADS AND TRAILS ASSESSMENT



INTERAGENCY BURNED AREA EMERGENCY STABILIZATION & REHABILITATION PLAN

PART F - SPECIFICATION

SPECIFICATION TITLE:	Culvert and Ditch Cleaning	JURISDICTIONS:	USFS
PART E: LINE ITEM:	#14, Culvert and Ditch Cleaning	FISCAL YEAR:	2002

I. WORK TO BE DONE

Number and Describe Each Task:

A. General Description:

Maintain culverts and ditches to restore full function. This includes, ditch cleaning, selective berm removal, spot surface grading to restore drainage, culvert cleaning at inlets and outlets, and clearing floatable debris from culvert catch basins and channels immediately upstream.

B. Location (Suitable) Sites:

Throughout Missionary Ridge Complex – (Refer to most recent road condition survey)

C. Design/Construction Specifications:

1. Clean culverts of all trash, debris and sediment.
2. Remove floatable material that could plug drainage facilities.
3. Clean ditches to provide for uninterrupted drainage. If ditch is currently grassed in and continues to provide drainage do not disturb the vegetated layer.
4. Clean ditch and restore catch basin to original conditions. Remove all material that interferes with the inlet and outlet of the ditch and drainage through the culvert.
5. Dispose of material outside of drainage area in locations where it will not be delivered to stream channels as designated.
6. Spot grade the road surface to restore proper drainage.
7. Selectively remove outside berms that interfere with drainage.

D. Purpose of Treatment Specifications:

Provides for free and open drainage through ditches and culverts.

E. Treatment Effectiveness Monitoring:

Monitoring will be completed by FS employees and road maintenance crews.

II. LABOR, MATERIALS AND OTHER COSTS:

PERSONAL SERVICES	Cost/Hour	# of Hours	COST/ITEM
Do not include contract personnel costs here			
GS-11	\$36.00	80	\$2,880.00
GS-9	\$25.00	160	\$4,000.00
WG-10-BLADE	\$30.00	480	\$14,400.00
WG-5	\$15.00	480	\$7,200.00
WG-10-BACKHOE	\$30.00	480	\$14,400.00
			\$0.00
			\$0.00
			\$0.00
			\$0.00
			\$0.00
			\$0.00
			\$0.00
			\$0.00
TOTAL PERSONNEL SERVICE COST			\$42,880.00



EQUIPMENT PURCHASE, LEASE OR RENTAL	Cost/Day- Cost/Hour	# of Days- # of Hours	COST/ITEM
*Purchase requires written justification			
BLADE FOR	\$861.00	3	\$2,583.00
BLADE USE	\$13.62	400	\$5,448.00
BACKHOE FOR	\$535.00	3	\$1,605.00
BACKHOE USE	\$12.00	400	\$4,800.00
DUMP FOR	\$507.00	3	\$1,521.00
PU FOR	\$185.00	6	\$1,110.00
PU USE	\$0.28	6000	\$1,680.00
DUMP USE	\$1.05	2000	\$2,100.00
TOTAL EQUIPMENT PURCH, LEASE, RENT COST			\$20,847.00

MATERIALS AND SUPPLIES	Cost Each	Quantity	COST/ITEM
MISC	\$2,500.00	1	\$2,500.00
			\$0.00
			\$0.00
			\$0.00
			\$0.00
			\$0.00
TOTAL MATERIALS AND SUPPLIES COST			\$2,500.00

TOTAL COST BY JURISDICTION	UNITS TREATED	COST
USFS	240	\$66,227.00
TOTAL COST		\$66,227.00



SPECIFICATION COST SUMMARY

FISCAL YEAR	UNIT	UNIT COST	# OF UNITS	COST	FUNDING SOURCE	METHOD
FY 2002	MILE	275.95	80	22,076	EFR	P
FY 2003	MILE	275.95	80	22,076	EFR	P
FY 2004	MILE	275.95	80	22,076	EFR	P
TOTAL		\$827.85		\$66,228		

FUNDING SOURCES:

F = Fire Suppression Account
 EFR=Emergency Fire Rehabilitation
 OP/O =Agency Operating Fund
 EWP = Emergency Watershed Program

SPECIFICATION TYPE

ES = Emergency Stabilization
 R = Rehabilitation
 FS = Fire Suppression

METHODS FOR COMPLETION

P=Agency Personnel Services
 C=Contract
 EFC= Emergency Fire Contract
 FC=Crew Labor Assigned to Fire

SOURCE OF COST ESTIMATE

1. Estimate obtained from 2-3 independent contractual sources.	
2. Documented cost figures from similar project work obtained from local agency sources.	
3. Estimate supported by cost guides from independent sources or other federal agencies.	
4. Estimates based upon government wage rates and material cost.	P, M
5. No cost estimate required – cost charged to Fire Suppression Account.	

P = Personnel Services M = Materials/Supplies T = Travel C = Contract F = Suppression

III. RELEVANT DETAILS, MAPS AND DOCUMENTATION INCLUDED IN THIS REPORT:

List Relevant Documentation and Cross-References Within ESR Plan:

APPENDIX I, ROADS AND TRAILS ASSESSMENT





BURNED AREA EMERGENCY STABILIZATION & REHABILITATION PLAN

PART F - SPECIFICATION

SPECIFICATION TITLE:	Hazard Tree Treatment – Trails in Wilderness	JURISDICTIONS:	USFS
PART E: LINE ITEM:	#20, Hazard Tree Treatment	FISCAL YEAR:	2003

I. WORK TO BE DONE

Number and Describe Each Task:

A. General Description:

Identify and fall hazard trees along trail systems within the fire. Hazard tree treatment will be conducted following the winter season and prior to use by the public to insure the health and safety of visitors to public lands.

B. Location (Suitable) Sites:

Trees within one tree length of wilderness trails within high and moderate burn intensity areas.

C. Design/Construction Specifications:

1. Have a forester identify site specific locations along trails for hazard tree removal in accordance with Agency guidelines for tree hazard treatment.
2. Tree hazards identified through inventory and Agency rating systems will be marked for treatment.
3. Directionally fell trees away from trails.
4. Stumps of identified tree hazards should be flush cut as low as possible or treated in accordance with Agency standards.
5. Leave all felled hazard trees tree length. Cut and scatter limbs in lengths in accordance with Agency standards.
6. Monitor trails for next two years for further tree hazards.

D. Purpose of Treatment Specifications:

Provide for public safety on public lands through the prompt treatment of short-term tree hazards that pose a threat to human health and safety.

E. Treatment Effectiveness Monitoring:

Monitoring will be accomplished throughout the recreation season by trail and recreation crews.

II. LABOR, MATERIALS AND OTHER COSTS:

PERSONAL SERVICES	Cost/Hour	# of Hours	COST/ITEM
Do not include contract personnel costs here			
GS-7	\$16.25	120	\$1,950.00
GS-5	\$12.81	240	\$3,074.40
GS-11 SAFETY INSPECTOR	\$25.00	24	\$600.00
			\$0.00
			\$0.00
			\$0.00
			\$0.00
			\$0.00
			\$0.00
			\$0.00
			\$0.00
			\$0.00
			\$0.00
TOTAL PERSONNEL SERVICE COST			\$5,624.40



MATERIALS AND SUPPLIES	Cost Each	Quantity	COST/ITEM
2 CROSS CUT SAWS	\$200.00	2	\$400.00
			\$0.00
			\$0.00
			\$0.00
			\$0.00
			\$0.00
TOTAL MATERIALS AND SUPPLIES COST			\$400.00

TRAVEL COST	Cost/Hour	# of Hours	COST/ITEM
PER DIEM PER DAY (NOT PER HOUR)	\$16.00	45	\$720.00
6 TRIPS @ 40 MILES (COST PER MILE)	\$0.35	240	\$84.00
			\$0.00
			\$0.00
			\$0.00
TOTAL TRAVEL COST			\$804.00

TOTAL COST BY JURISDICTION	UNITS TREATED	COST
USFS		\$6,828.00
TOTAL COST		\$6,828.00



SPECIFICATION COST SUMMARY

FISCAL YEAR	UNIT	UNIT COST	# OF UNITS	COST	FUNDING SOURCE	METHOD
FY 1	WORK DAY	455.20	15	\$6,828		
FY 2						
FY 3						
TOTAL		\$455.20		\$6,828		

FUNDING SOURCES:

F = Fire Suppression Account

EFR=Emergency Fire Rehabilitation

OP/O =Agency Operating Fund

EWP = Emergency Watershed Program

SPECIFICATION TYPE

ES = Emergency Stabilization

R = Rehabilitation

FS = Fire Suppression

METHODS FOR COMPLETION

P=Agency Personnel Services

C=Contract

EFC= Emergency Fire Contract

FC=Crew Labor Assigned to Fire

SOURCE OF COST ESTIMATE

1. Estimate obtained from 2-3 independent contractual sources.	
2. Documented cost figures from similar project work obtained from local agency sources.	
3. Estimate supported by cost guides from independent sources or other federal agencies.	
4. Estimates based upon government wage rates and material cost.	
5. No cost estimate required – cost charged to Fire Suppression Account.	

P = Personnel Services M = Materials/Supplies T = Travel C = Contract F = Suppression

III. RELEVANT DETAILS, MAPS AND DOCUMENTATION INCLUDED IN THIS REPORT:

List Relevant Documentation and Cross-References Within ESR Plan:

SEE APPENDIX I, ROADS AND TRAILS ASSESSMENT.



PART F - SPECIFICATION

I. WORK TO BE DONE

A. General Description:

B. Location (Suitable) Sites:

C. Design/Construction Specifications:

- D. Purpose of Treatment Specifications:**

E. Treatment Effectiveness Monitoring:

II. LABOR, MATERIALS AND OTHER COSTS:

- 89 -



EQUIPMENT PURCHASE, LEASE OR RENTAL *Purchase requires written justification	Cost/Day- Cost/Hour	# of Days- # of Hours	COST/ITEM
Vehicle FOR	\$7.50	30	\$225.00
VEHICLE USE	\$0.25	1000	\$250.00
			\$0.00
			\$0.00
			\$0.00
			\$0.00
TOTAL EQUIPMENT PURCH, LEASE, RENT COST			\$475.00

MATERIALS AND SUPPLIES	Cost Each	Quantity	COST/ITEM
MISC	\$500.00	1	\$500.00
			\$0.00
			\$0.00
			\$0.00
			\$0.00
			\$0.00
TOTAL MATERIALS AND SUPPLIES COST			\$500.00

CONTRACT COST	Cost/Hour	# of Hours	COST/ITEM
CONTRACT	\$1,000.00	20	\$20,000.00
CONTRACT ADMIN = 10 PERCENT OF TOTAL			\$2,000.00
			\$0.00
			\$0.00
			\$0.00
TOTAL CONTRACT COST			\$22,000.00

TOTAL COST BY JURISDICTION	UNITS TREATED	COST
USFS	20	\$28,135.00
TOTAL COST		\$28,135.00



SPECIFICATION COST SUMMARY

FISCAL YEAR	UNIT	UNIT COST	# OF UNITS	COST	FUNDING SOURCE	METHOD
FY 2002	MILE	1307	20	26,140	EFR	P, C
FY 2003	LS	2000	1	2000	EFR	P
FY 3						
TOTAL		\$3,307		\$28,140		

FUNDING SOURCES:

F = Fire Suppression Account
 EFR=Emergency Fire Rehabilitation
 OP/O =Agency Operating Fund
 EWP = Emergency Watershed Program

SPECIFICATION TYPE

ES = Emergency Stabilization
 R = Rehabilitation
 FS = Fire Suppression

METHODS FOR COMPLETION

P=Agency Personnel Services
 C=Contract
 EFC= Emergency Fire Contract
 FC=Crew Labor Assigned to Fire

SOURCE OF COST ESTIMATE

1. Estimate obtained from 2-3 independent contractual sources.	
2. Documented cost figures from similar project work obtained from local agency sources.	
3. Estimate supported by cost guides from independent sources or other federal agencies.	C
4. Estimates based upon government wage rates and material cost.	P
5. No cost estimate required – cost charged to Fire Suppression Account.	

P = Personnel Services M = Materials/Supplies T = Travel C = Contract F = Suppression

III. RELEVANT DETAILS, MAPS AND DOCUMENTATION INCLUDED IN THIS REPORT:

List Relevant Documentation and Cross-References Within ESR Plan: See Appendix I, Roads and Trails Assessment.



BURNED AREA EMERGENCY STABILIZATION & REHABILITATION PLAN

PART F - SPECIFICATION

SPECIFICATION TITLE:	Hazard Tree Treatment – Trails not in Wilderness	JURISDICTIONS:	USFS
PART E: LINE ITEM:	#21, Hazard Tree Treatment	FISCAL YEAR:	2002

I. WORK TO BE DONE

Number and Describe Each Task:

A. General Description:

Identify and fall hazard trees along trail systems within the fire area. Hazard tree treatment will be conducted following the winter season and prior to use by the public to insure the health and safety of visitors to public lands.

B. Location (Suitable) Sites:

Trees within one tree length of trails roads and campgrounds within high and moderate burn intensity areas.

C. Design/Construction Specifications:

1. Have a forester identify site specific locations along trails and campgrounds for hazard tree removal in accordance with Agency guidelines for tree hazard treatment.
2. Tree hazards identified through inventory and Agency rating systems will be marked for treatment.
3. Directionally fell trees away from trails and campsites.
4. Stumps of identified tree hazards should be flush cut as low as possible or treated in accordance with Agency standards.
5. Leave all felled hazard trees tree length. Cut and scatter limbs in lengths in accordance with Agency standards.
6. Monitor campgrounds and trails for next two years for further tree hazards.

D. Purpose of Treatment Specifications:

Provide for public safety on public lands through the prompt treatment of short-term tree hazards that pose a threat to human health and safety.

E. Treatment Effectiveness Monitoring:

Monitoring will be done throughout the year by district trail and recreation employees on a periodic basis.

II. LABOR, MATERIALS AND OTHER COSTS:

PERSONAL SERVICES	Cost/Hour	# of Hours	COST/ITEM
Do not include contract personnel costs here			
GS-7	\$17.00	260	\$4,420.00
GS-5 (3)	\$13.00	760	\$9,880.00
GS-11 SAFETY	\$25.00	32	\$800.00
			\$0.00
			\$0.00
			\$0.00
			\$0.00
			\$0.00
			\$0.00
			\$0.00
			\$0.00
			\$0.00
TOTAL PERSONNEL SERVICE COST			\$15,100.00



EQUIPMENT PURCHASE, LEASE OR RENTAL	cost		
*Purchase requires written justification	UNIT	Number	COST/ITEM
			\$0.00
CHAINSAW GAS, OIL, CHAIN FILES, WEDGES	\$1,000.00	1	\$1,000.00
4 CHAINSAWS	\$500.00	4	\$2,000.00
			\$0.00
			\$0.00
			\$0.00
TOTAL EQUIPMENT PURCH, LEASE, RENT COST			\$3,000.00

TRAVEL COST	Cost/Hour	# of Hours	COST/ITEM
TRAVEL TO WORKSITE (40 MI/DAY*40 DAYS*.35/MILE*2 VEHIC.)			\$1,120.00
SAFETY TRIPS			\$56.00
			\$0.00
			\$0.00
			\$0.00
TOTAL TRAVEL COST			\$1,176.00

	TREATED	COST
USFS		19276
TOTAL COST		\$19,276.00



SPECIFICATION COST SUMMARY

FISCAL YEAR	UNIT	UNIT COST	# OF UNITS	COST	FUNDING SOURCE	METHOD
FY 1	MILES	990	19.5	\$19276		
FY 2						
FY 3						
TOTAL		\$990		\$19,276		

FUNDING SOURCES:

F = Fire Suppression Account

EFR=Emergency Fire Rehabilitation

OP/O =Agency Operating Fund

EWP = Emergency Watershed Program

SPECIFICATION TYPE

ES = Emergency Stabilization

R = Rehabilitation

FS = Fire Suppression

METHODS FOR COMPLETION

P=Agency Personnel Services

C=Contract

EFC= Emergency Fire Contract

FC=Crew Labor Assigned to Fire

SOURCE OF COST ESTIMATE

1. Estimate obtained from 2-3 independent contractual sources.	
2. Documented cost figures from similar project work obtained from local agency sources.	
3. Estimate supported by cost guides from independent sources or other federal agencies.	
4. Estimates based upon government wage rates and material cost.	
5. No cost estimate required – cost charged to Fire Suppression Account.	

P = Personnel Services M = Materials/Supplies T = Travel C = Contract F = Suppression

III. RELEVANT DETAILS, MAPS AND DOCUMENTATION INCLUDED IN THIS REPORT:

List Relevant Documentation and Cross-References Within ESR Plan:

SEE APPENDIX I, ROADS AND TRAILS ASSESSMENT.





BURNED AREA EMERGENCY STABILIZATION & REHABILITATION PLAN

PART F - SPECIFICATION

SPECIFICATION TITLE:	Replace/Improve Trail Drainage Structures	JURISDICTIONS:	USFS
PART E: LINE ITEM:	#17, Trail Drainage Structures	FISCAL YEAR:	2002, 2003, 2004

I. WORK TO BE DONE

Number and Describe Each Task:

A. General Description:

Install and/or replace drainage structures lost in high intensity burn sections. Spot treat tread berms to regain erosion control on burned over trail segments. Armour creek crossings where excessive runoff can be expected to lead to scouring and ford destruction. Spot tread stabilization and upgrade to reduce threats to users. Install larger culverts or additional culverts where a change in run-off is expected to overwhelm existing drainage structures. Outyear effectiveness monitoring

B. Location (Suitable) Sites:

Trails throughout the burned area as shown on the Post Burn Trail Inventory Spread Sheet.

C. Design/Construction Specifications:

1. Spot tread stabilization and upgrade will involve the following: replacement of failed, rock cribbing or grading to repair burned out stump holes and tread prism loss; armoring/shoring up slopes under trail tread with rock cribbing or wire baskets.
2. Drainage structures needed will be water bars of rock or native material or drain dips. Material may come from native trees, 8-12" diameter 1st preference Douglas fir, 2nd, lodge pole or treated logs. Rock is preferable where a source exists. Installation of structures will follow standard specifications. In places, armored dips or armored crossings will be preferable to culverts or waterbars. This will be determined by trails specialist in advance of work and staked on the ground. Installation of structures will follow standard FS specifications. In places, armored dips or armored crossings will be preferable to culverts or waterbars. This will be determined by trails specialist in advance of work and staked on the ground. Culverts will be installed to standard trail spec and will generally be 18" in diameter, 6' length to accommodate increased sediment loads. Spot berm removal will be done in various locations where tread is outsloped and stable but channels water.
3. Visitor information signing will require posting a weather-resistant, professionally-built sign at trailheads that notifies users of fire-related hazards that may be outside the normal range for the area. Snags, tread damage, fire-weakened trees and tread damage. Maintain the sign during effectiveness monitoring period.

D. Purpose of Treatment Specifications:

Correction of emergency threats to users and reducing loss of public property.

E. Treatment Effectiveness Monitoring:

FY2002: field review a sample of trails in high intensity burn areas for effectiveness of tread stabilization and drainage repairs. Photograph sample drainage structure and tread stabilization segment where feasible to establish photo points. Document findings. Document reports of further tread failures and drainage related damage as reported by users and Force Account crews; survey those same year and report for subsequent BAER funds. FY2003, 2004: continued review of photo points as well as photographing further treatments, as needed. Maintain file of photos and trail surveys related to fire damage.



II. LABOR, MATERIALS AND OTHER COSTS:

PERSONAL SERVICES			
Do not include contract personnel costs here	Cost/Hour	# of Hours	COST/ITEM
GS-7 SUPERVISOR	\$23.00	400	\$9,200.00
GS-5 (Trail crew of minimum of 2) 400 hrs ea	\$15.00	800	\$12,000.00
GS11 District Rec Staff	\$36.00	100	\$3,600.00
			\$0.00
Crew time for force account work on drainages, tread			\$0.00
stabilization, drainage structure and culvert installation,			\$0.00
and contract oversight.			\$0.00
			\$0.00
			\$0.00
			\$0.00
			\$0.00
			\$0.00
TOTAL PERSONNEL SERVICE COST			\$24,800.00

EQUIPMENT PURCHASE, LEASE OR RENTAL	Cost/Day- Cost/Hour	# of Days- # of Hours	COST/ITEM
*Purchase requires written justification			
MISC	\$1,000.00	1	\$1,000.00
			\$0.00
			\$0.00
			\$0.00
			\$0.00
			\$0.00
TOTAL EQUIPMENT PURCH, LEASE, RENT COST			\$1,000.00

MATERIALS AND SUPPLIES	Unit Cost	Number	Cost
TRAVEL COST			
Treat 2 DAYS/WEEK FOR 4 PPL FOR 20 WEEKS	\$50.00	8	\$4,000.00
Culverts FOR and USE on FS fleet			\$3,000.00
			\$0.00
			\$0.00
			\$0.00
TOTAL TRAVEL COST			\$7,000.00



CONTRACT COST	Cost/Hour	# of Hours	COST/ITEM
CONTRACT - Water Bar Installation 1093@\$75=			\$81,975.00
- Tread Stabilization 11000 @ \$2/ft=			\$22,000.00
			\$0.00
			\$0.00
			\$0.00
TOTAL CONTRACT COST			\$103,975.00

A.

TOTAL COST BY JURISDICTION	UNITS TREATED	COST
USFS		\$145,175.00
TOTAL COST		\$145,175.00

SPECIFICATION COST SUMMARY

FISCAL YEAR	UNIT	UNIT COST	# OF UNITS	COST	FUNDING SOURCE	METHOD
FY 2002	A. MILES	B. \$7151	C. 20.3	D. \$145,175	E. EFR	F. C, P
FY 2	G.	H.	I.	J.	K.	L.
FY 3	M.	N.	O.	P.	Q.	R.
TOTAL	S.	T. \$7,151	U.	V. \$145,175	W.	X.

FUNDING SOURCES:

F = FIRE SUPPRESSION
ACCOUNTEFR=EMERGENCY FIRE
REHABILITATIONOP/O =AGENCY OPERATING
FUNDEWP = EMERGENCY
WATERSHED PROGRAM

Specification type

ES = EMERGENCY
STABILIZATION

R = REHABILITATION

FS = FIRE SUPPRESSION

methods for completion

P=AGENCY PERSONNEL
SERVICES

C=CONTRACT

EFC= EMERGENCY FIRE
CONTRACTFC=CREW LABOR ASSIGNED
TO FIRE

**SOURCE OF COST ESTIMATE**

1. Estimate obtained from 2-3 independent contractual sources.	
2. Documented cost figures from similar project work obtained from local agency sources.	
3. Estimate supported by cost guides from independent sources or other federal agencies.	P, M
4. Estimates based upon government wage rates and material cost.	
5. No cost estimate required – cost charged to Fire Suppression Account.	

P = Personnel Services **M** = Materials/Supplies **T** = Travel **C** = Contract **F** = Suppression

III. RELEVANT DETAILS, MAPS AND DOCUMENTATION INCLUDED IN THIS REPORT:

List Relevant Documentation and Cross-References Within ESR Plan:

SEE APPENDIX I, ROADS AND TRAILS ASSESSMENTS



BURNED AREA EMERGENCY STABILIZATION & REHABILITATION

PART F - SPECIFICATION

SPECIFICATION TITLE:	Hazard Tree Treatment – In Wilderness Campsites	JURISDICTIONS:	
PART E LINE ITEM:	#22 Hazard Tree Treatment-Wilderness	FISCAL YEAR:	2002

I. WORK TO BE DONE

1. General Description:

Conduct Hazard Tree removal in known campsites within the fire area to identify threatened public safety following hazard tree assessment. Hazard tree treatment will be conducted following the winter season and prior to use by the public to insure the health and safety of visitors to public lands.

2. Location (Suitable) Sites: Trees within one tree length of campsites within the fire area.

3. Design/Construction Specification(s):

1. Treat identified tree hazards within one tree length of campsites within the Missionary Ridge Complex Fire area in accordance with Agency guidelines for tree hazard treatment.
2. Tree hazards identified through inventory and Agency rating systems will be marked for treatment.
3. Directionally fell trees away from campsites.
4. Stumps of identified tree hazards to be cut as low as possible to the ground and rub stumps with dirt or ash to camouflage.
5. Leave all felled hazard trees. Clear off trees from immediate camping site. On down logs, align saw cuts to minimize visual impacts. Slope/angle cuts away from line of sight to hide them when possible. Rub exposed log ends with dirt or ash to camouflage. Cut and scatter limbs in lengths in accordance with Agency standards.
6. Monitor camp areas for next two years for further tree hazards.

4. Purpose of Treatment Specification: Provide for public safety on public lands through the prompt treatment of short-term tree hazards that pose a threat to human health and safety.

II. LABOR, MATERIALS AND OTHER COST

PERSONNEL SERVICES (Grade @ cost/hour X # hours X fiscal year = cost/item) Do not include contract personnel costs here - see contract services below	COST/ITEM
GS-7 Wilderness supervisor @ 15.75/Hour x 40 Hours x 1 person	\$630
GS-5 Wilderness Ranger @ \$12.83/ Hour x 120 Hours x 2 personnel	\$3,079
TOTAL PERSONNEL SERVICE COST	\$3709
EQUIPMENT PURCHASE, LEASE OR RENTAL (item @ cost/hour or day X #hours or days X fiscal year = cost) Do not include contract personnel costs here -see contract services below	COST/ITEM
Cross-cut saws – purchase 2 cross-cuts @ \$300/each x 2	\$600
TOTAL EQUIPMENT PURCHASE, LEASE, OR RENTAL COST	\$600
MATERIALS AND SUPPLIES (item @ cost/each X quantity x fiscal year = cost)	COST/ITEM
Cross-cut saw, wedges, files, sharpening - \$30.00/day X 5 days x 2 saws	\$300
Chainsaw fuel, oil, chain, files, falling wedges- \$20/day x 20 days x 2 saws	\$800
TOTAL MATERIALS AND SUPPLY COST	\$1,100
TRAVEL COST (Personnel @ rate X round trips X fiscal year = cost)	COST/ITEM



TRAVEL COST (Personnel @ rate X round trips X fiscal year = cost)	COST/ITEM
Field per diem \$16/day x 60 days x 2 people	\$1,920
50 miles/ day x 8 days x .35/ mile (travel)	\$140
TOTAL TRAVEL COST	\$2,060
CONTRACT COST (Labor, equipment, and travel @ cost/hr. X hrs. X fiscal year = cost)	COST/ITEM
TOTAL CONTRACT COST	

III. SPECIFICATION COST SUMMARY

FISCAL YEAR	UNIT	UNIT COST	# OF UNITS	COST	FUNDING SOURCE	METHOD
FY-1	Treatment Days	\$497.93	15	\$7469	ES	P
TOTAL	Treatment Days					

FUNDING SOURCES:

F = Fire Suppression Account

ESR = Emergency Stabilization & Rehabilitation

OP/O = Agency Operating or Other Account

EWP = Emergency Watershed Protection (NRCS)

SPECIFICATION TYPE

ES = Emergency Stabilization

R = Rehabilitation

FS = Fire Suppression

METHODS FOR COMPLETION:

P = Agency Personnel Services

C = Contract

EFC = Emergency Fire Contract

FC = Crew Labor Assigned to Fire

IV. SOURCE OF COST ESTIMATE

1. Estimate obtained from 2 - 3 independent contractual sources	
2. Documented cost figures from similar project work obtained from local agency resources	
3. Estimate supported by cost guides from independent sources or other federal agencies	P, M, T
4. Estimate based upon government wage rates and materials cost	
5. No cost estimate required - cost charged to Fire Suppression Account	

P = Personnel Services

M = Materials/Supplies

T = Travel

C = Contract

F = Fire Suppression

V. RELEVANT DETAILS, MAPS, AND DOCUMENTATION INCLUDED IN REPORT

List relevant documentation and cross-references within ESR Plan: Please refer to Operations Assessment, and Supporting Documentation File.

VI. UNITS AND COSTS BY JURISDICTION

JURISDICTION	UNITS TREATED	COST
FS - San Juan National Forest	15 Treatment Days	\$7469.00
TOTAL COST		

BURNED AREA EMERGENCY STABILIZATION & REHABILITATION

PART F - SPECIFICATION

SPECIFICATION TITLE:	Hazard Tree Treatment-Within Campgrounds	JURISDICTIONS:	USFS
PART E LINE ITEM:	#23, Hazard Tree Treatment	FISCAL YEAR:	2002

I. WORK TO BE DONE

1. General Description:

Conduct hazard tree removal adjacent to and within campgrounds within the fire area to identify threatened public safety following hazard tree assessment. Hazard tree treatment will be prior to use by the public to insure the health and safety of visitors to public lands.

2. Location (Suitable) Sites- See burn severity map and the following campgrounds:

Campground	Acres Burned
Transfer park	11
Old Timers	2
Graham Creek	13
North Canyon	17
Pine Point	19
Pine River	3
Total	65

3. Design/Construction Specification(s):

1. Treat identified tree hazards within one tree length of campgrounds within the Missionary Ridge Complex Fire area in accordance with Agency guidelines for tree hazard treatment.
2. Tree hazards identified through inventory and Agency rating systems will be marked for treatment.
3. Directionally fell trees away from roads, campsites, and trails.
4. Stumps of identified tree hazards may be flush cut as low as possible or treated in accordance with Agency standards.
5. Monitor campgrounds for next two years for further tree hazards.
6. Remove all felled trees and limbs.

4. Purpose of Treatment Specification: Provide for public safety on public lands through the prompt treatment of short-term tree hazards that pose a threat to human health and safety.

II. LABOR, MATERIALS AND OTHER COST

PERSONNEL SERVICES (Grade @ cost/hour X # hours X fiscal year = cost/item) Do not include contract personnel costs here - see contract services below	COST/ITEM
SJNF- GS-5 Maintenance Specialist @ \$12.83/ Hour x 320 Hours x 4 personnel	\$16,422.4
TOTAL PERSONNEL SERVICE COST	\$16,422.4
EQUIPMENT PURCHASE, LEASE OR RENTAL (item @ cost/hour or day X #hours or days X fiscal year = cost) Do not include contract personnel costs here -see contract services below	COST/ITEM
TOTAL EQUIPMENT PURCHASE, LEASE, OR RENTAL COST	

TOTAL EQUIPMENT PURCHASE, LEASE, OR RENTAL COST	
MATERIALS AND SUPPLIES (item @ cost/each X quantity x fiscal year = cost)	COST/ITEM
FS-SJNF- Chainsaw fuel, oil, chain, files, falling wedges- \$20/day x 40 days x 4 saws	\$3200
TOTAL MATERIALS AND SUPPLY COST	\$3200
TRAVEL COST (Personnel @ rate X round trips X fiscal year = cost)	COST/ITEM
FS- SJNF- 40 miles/ day x 40 day s x .35/ mile X 2 vehicles	\$1120
TOTAL MATERIALS AND SUPPLY COST	\$1120
CONTRACT COST (Labor, equipment, and travel @ cost/hr. X hrs. X fiscal year = cost)	COST/ITEM
TOTAL CONTRACT COST	

III. SPECIFICATION COST SUMMARY

FISCAL YEAR	UNIT	UNIT COST	# OF UNITS	COST	FUNDING SOURCE	METHOD
FY-1- SJNF	Treatment Days	\$518.56	40	\$20,742	ES	P

FUNDING SOURCES:

F = Fire Suppression Account

ESR = Emergency Stabilization & Rehabilitation

OP/O = Agency Operating or Other Account

EWP = Emergency Watershed Protection (NRCS)

SPECIFICATION TYPE

ES = Emergency Stabilization

R = Rehabilitation

FS = Fire Suppression

METHODS FOR COMPLETION:

P = Agency Personnel Services

C = Contract

EFC = Emergency Fire Contract

FC = Crew Labor Assigned to Fire

IV. SOURCE OF COST ESTIMATE

1. Estimate obtained from 2 - 3 independent contractual sources	
2. Documented cost figures from similar project work obtained from local agency resources	
3. Estimate supported by cost guides from independent sources or other federal agencies	P, M, T
4. Estimate based upon government wage rates and materials cost.	
5. No cost estimate required - cost charged to Fire Suppression Account	

P = Personnel Services

M = Materials/Supplies

T = Travel

C = Contract

F = Fire Suppression

V. RELEVANT DETAILS, MAPS, AND DOCUMENTATION INCLUDED IN REPORT

List relevant documentation and cross-references within ESR Plan: Please refer to Operations Assessment, and Supporting Documentation File.

VI. UNITS AND COSTS BY JURISDICTION

JURISDICTION	UNITS TREATED	COST
FS- San Juan National Forest	Treatment Days	\$20,742
TOTAL COST	Treatment Days	\$20,742

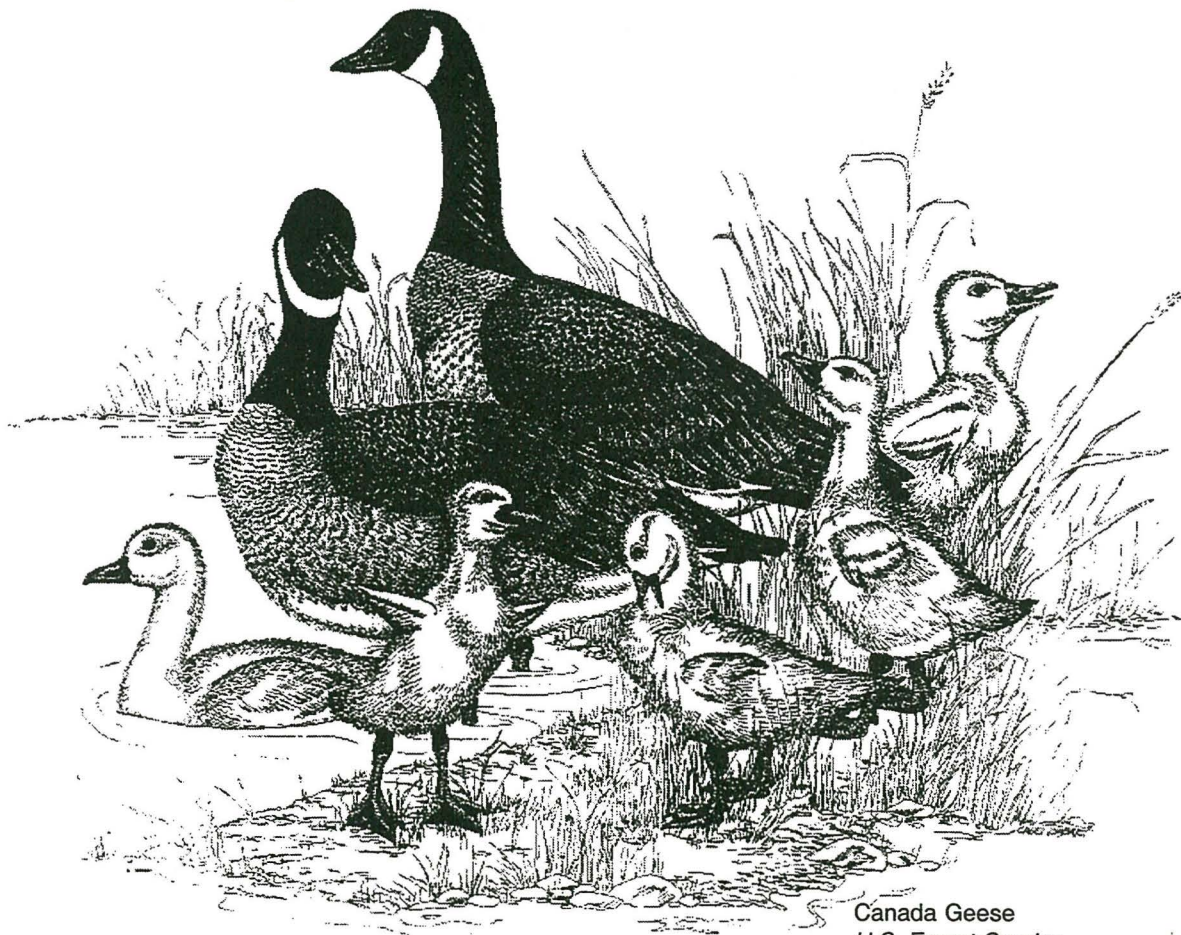




PART G ~ POST-REHABILITATION RECOMMENDATIONS

I. Long-Term Monitoring:

- ☐ Monitor Aerial Seeding Effectiveness
- ☐ Monitor Vegetative Recovery
- ☐ Monitor Cultural Site Treatments
- ☐ Maintain Installed Treatments



Canada Geese
U.S. Forest Service



PART G ~ CONSULTATIONS

Name	Affiliation
Bob Harrington	Colorado State Forest Service
Brett Boyer	Town of Bayfield
Kalen Elliott	Basin Coop
Tom Campbell	Basin Coop
Jim Davis	La Plata County Engr
Doyle Villers	La Plata County Road & Bridge
Kent Grant	CO State Forest Service, Durango
Kinsey Holton	City of Durango
Jack Rogers	City of Durango
Brad Dodd	Bureau of Reclamation
Dan Lynn	NRCS
Sterling Moss	NRCS
Jim Davis	LaPlata County Engineer
Jay Hudgpeth	PRID Bayfield
Butch Knowlton	Director of Emergency Preparedness LaPlata Co.
Dan Wand	CO State Forest Service



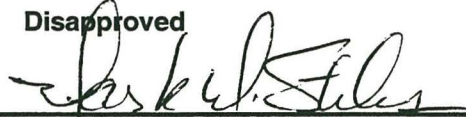
PART I. REVIEW AND APPROVAL

II. EMERGENCY FIRE STABILIZATION APPROVAL

☒ Approved

☐ Approved with Revision

☐ Disapproved



Forest Supervisor, San Juan National Forest

July 13, 2002

Date

Appendix I. BAER TEAM RESOURCE ASSESSMENTS

- Soil and Watershed Assessment
- Cultural Resource Assessment
- Range Resource Assessment
- Vegetation Resource Assessment
- Fish & Wildlife Resource Assessment
- Timber Resource Assessment
- Road & Trails Assessment
- Recreation Assessment
- Noxious and Invasive Weed Assessment
- Wilderness Resource Assessment







MISSIONARY RIDGE COMPLEX

SOIL AND WATERSHED RESOURCE ASSESSMENT

I. OBJECTIVES

- Assess overall watershed changes caused by the fire, particularly those that pose substantial threats to human life, property, and critical natural and cultural resources. This includes evaluating changes to soil conditions, hydrologic function, and watershed response to precipitation events.
- Identify the most critical soil and watershed areas and issues related to the Missionary Ridge Complex based on increased flood and debris flow potential and loss of soil resources, and prescribe treatments, if necessary, to mitigate impacts and risks.
- Develop maps of burn severity, values at risk, flood zones, debris flow source areas, and treatments.
- Identify future monitoring needs.

II. ISSUES

- Potential threats to human life and property downstream of the Missionary Ridge and Valley Fires from potential increases in storm flow runoff, flooding, and debris flows.
- Potential threats to Durango and Bayfield's water supplies and Lemon and Vallecito Reservoirs.
- Potential loss of soil productivity and increased erosion.
- BAER cannot design treatments to protect against all scales of flood and debris flow events.

III. OBSERVATIONS

A. BACKGROUND

1. Geology/Physiography

The Missionary Ridge Complex is located north and northeast of Durango, Colorado and includes portions of the Animas, Florida, and Pine River Valleys. The fire occurred within the Southern Rocky Mountain physiographic province, near the boundary with the San Juan Basin in the Navajo section of the Colorado Plateau province occurring to the south. The burned area ranges from approximately 6,500 feet along the Animas Valley to approximately 11,400 feet in the northern portion of the fire.

The town of Durango is built on Animas River gravels, which rest upon late Cretaceous sedimentary rocks, principally the Mancos Shale. The surrounding mountains are composed of interbedded sandstones, shales, limestones, and conglomerates resting on the older quartzites, gneisses, schists, and the granites (Figure 1, Geologic Mapping Units).

The geologic formations within and immediately adjacent to the Missionary Ridge Complex are listed in increasing order of age in Table 1, Missionary Ridge Complex Geologic Mapping Units. The sedimentary formations generally dip gently to the south in the northern portion of the fire area, and moderately to the south in the southern portion of the area, forming gentle hogbacks and dip slopes underlain by Dakota Sandstone and Mancos Shale. In the vicinity of the southern end of Lemon Reservoir, the beds dip steeply as much as 60 degrees and the more resistant sandstone formations of the Dolores, Entrada, lower portion of the Morrison, and Dakota Formations form prominent hogbacks.



Slope stability issues are common in the area. Debris flows are frequently generated from the Cutler Formation and Eolus Granite, and with less frequency, from the Hermosa and Morrison Formations. Active, large alluvial fans have developed at the mouths of tributaries to the Animas River along the mountain front, and to a lesser extent in other areas.

Large, deep-seated, and small rotational slumps and translational slides are common in the Hermosa formation. The Morrison formation hosts several extensive slow-moving, deep-seated landslides on the moderate dip slopes to the south of the fire area. Medium size rotational slumps are common in the Morrison Formation where it occurs below hogbacks formed by thick, highly jointed beds of the Dakota Formation. Large blocks of sandstone are transported down slope as part of these slides. Large translational landslides are common in the Mancos Shale in the southern portion of the area where it overlies moderately dipping Dakota Sandstone.

Rockfalls commonly originate in the Dakota and Hermosa Formations, and talus slopes comprised of smaller rocks frequently form from Junction Creek Sandstone. Rockfalls have frequently reached the alluvial fans and colluvial slopes along the east side of the Animas Valley.

See Figure 1 - next page.

Geologic Mapping Units

Missionary Ridge Complex

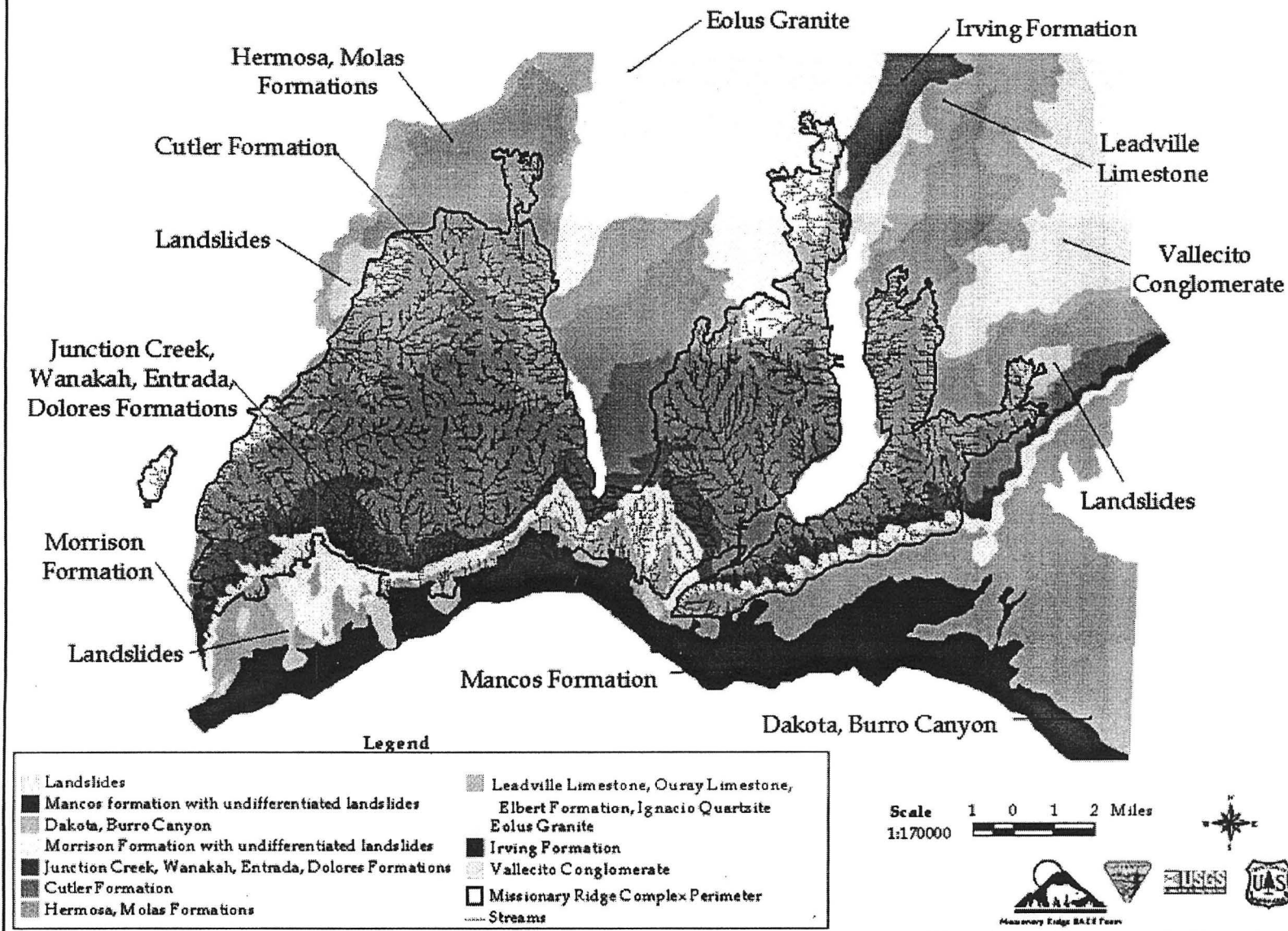


Figure 1. Geologic mapping units within the Missionary Ridge Complex.

Table 1: Missionary Ridge Complex geologic mapping units.

Mapping Units	Description	Risk of Occurrence in Mapping Unit		
		Landslide	Debris Flow	Rockfall
Landslides	Larger older and recent landslides	H	M	L
Mancos Formation with undifferentiated landslides	Shale and old to recent dip slope landslides	H	M	L
Dakota, Burro Canyon	Sandstone with some shale	L	L	H
Morrison Formation with undifferentiated landslides	Claystone, siltstone, mudstone and sandstone	H	H	L
Junction Creek, Wanakah, Entrada, Dolores Formations	Sandstone, with some shale and siltstone in the lowermost Dolores Formation	M	M	H
Cutler Formation	Shale, siltstone, sandstone and conglomerate	M	VH	L
Hermosa, Molas Formations	Shale, limestone and sandstone	H	H	H
Leadville Limestone, Ouray Limestone, Elbert Formation, Ignacio Quartzite	Limestone with some shale, sandstone and quartzite in the lower Elbert and Ignacio Formations	M	L	M
Eolus Granite	Granite	L	H	M
Irving Formation	Interlayered gneiss, quartzite and schist	L	L	M
Vallecito Conglomerate	Thin to thick-bedded meta-conglomerate and Quartzite	L	H	M

2. Soils

The information on soils is derived from the Soil Survey of the La Plata County Area, and the Piedra and the Animas-Dolores Soil Surveys, CO. 144 detailed soil mapping units occur within the fire among the three surveys.

The fire is located in the Missionary Ridge/Mosca subsection. It is composed of moderately steep to steep, slightly to highly dissected mountains slopes. Geology is associated with mixed sediments of the Cutler, Rico, Hermosa, Molas, Mancos Shale, Morrison and Dakota/Burro Canyon Formations. The soils are typically classified as alfisols (forest soil with an illuviated clay horizon). Three major types of alfisols occur, including alfisols with a semi-arid soil moisture regime (ustalfs), a udic, or "typical" alfisol (udalfs) and soils that occur in cold temperatures (cryalfs).

According to the soil surveys, approximately 20,000 acres of soils within the fire perimeter have an erosion hazard rating of severe. About half of those soils (10,200 acres) occur in areas that burned with high severity. These soils are formed in erosive sedimentary materials, typically on moderately steep to steep slopes, and are now susceptible to sheet, rill, and gully erosion due to loss of vegetative cover and duff/litter as a result of the fire. In some areas, soil and watershed conditions have been altered to such a degree that hillslopes are now prone to debris flows during high intensity, short duration thunderstorms (Cannon et. al, 2000).

3. Climate

Within the San Juan National Forest and Durango area, elevations range from 6,512 feet in Durango to over 14,000 feet in the nearby mountains. The San Juan region is semiarid, with

generally warm summers and cold winters; however, the weather and temperature vary significantly from one place to another. Durango's average high temperature in July is 85 degrees F, while the average at Red Mountain Pass (5,000 feet higher) is 64 degrees. Annual precipitation in Durango is 18.6 inches, with a winter snowfall total averaging about 70 inches. Forty-two percent of the precipitation in Durango falls from August to October. As temperatures begin to warm in late winter and early spring, moisture-laden storms surge in from the southwest, and more intense snowfalls can be expected. By late April, rainstorms become more common than snow at the lower elevations. By mid-July, violent afternoon thunderstorms become an almost daily event. These summer storms can be quite severe, with dangerous lightening and hail, but they are typically short-lived.

4. Hydrology

The flow regime of the analysis area is characterized by snowmelt peak flows in spring and peak flows in response to short duration, high intensity thunderstorms associated with the monsoon season. Occasional frontal precipitation events occur in the fall. Peak flows for the Los Pinos River near Bayfield, CO (Station 09353500) and Vallecito Creek near Bayfield, CO (Station 09352900) were analyzed using the USGS peakflow program. The 1.5-year flow for the Los Pinos River is 1,936 cfs and the 1.5-year flow for Vallecito Creek is 981 cfs. Peak flows for all return intervals for both stations can be found in Appendix V.

A. RECONNAISSANCE METHODS

The purpose of a burned area assessment is to determine if the fire caused emergency watershed conditions and if there are values at risk from those conditions. If an emergency is not identified, the assessment stops. If emergency watershed conditions are found, and values at risk are identified, then the magnitude and scope of the emergency is mapped and described, values at risk and resources to be protected are analyzed, and treatment prescriptions are developed to protect values at risk. Emergency watershed conditions include both hydrologic and soil factors; typically potential for flash floods and debris flows and deterioration of soil condition, particularly loss of soil cover, leading to a decline in soil productivity. Table 2 describes terms commonly used in assessing soils and watersheds that have been burned.

**Table 2.** Definitions of terms commonly used in soil and watershed burned area assessments.

Term	Definition
Fire Intensity	Based on temperature, flame length, rate of spread, heat of combustion and total amount and size of fuel consumed. Accounts for convective heat rising into the atmosphere and fire effects to the overstory.
Fire Severity	Based on temperature, moisture content of duff and fuels lying on the ground, heat of combustion of conductive and radiant heat that goes down into the soil, affecting soil characteristics.
Burn Severity	A relative measure of the degree of change in a watershed that relates to the severity of the effects of the fire on soil hydrologic function. Burn severity is delineated on topographic maps as polygons. Classes of burn severity are high, moderate, low, and unburned.
Watershed Response	A qualitative degree and/or modeled measure of how a watershed will respond to precipitation. Parameters include pre-existing soil moisture; amount of soil cover; amount and distribution of impermeable surfaces (rock outcrop, hydrophobic soils); amount and duration of rainfall; lag time between initiation of storm and peak flow runoff; and peak flow discharge and sediment delivery. Changes in the characteristics of a watershed caused by a fire will increase the efficiency with which a watershed yields runoff.

Burned area evaluations included, but were not limited to:

- Fire-caused changes in soil properties and hydrologic function
- Aerial extent and strength of hydrophobic soil conditions
- Mapping burn severity
- Conditions of sediment source areas
- Current channel and culvert capabilities
- Elevations of commercial and residential facilities relative to anticipated or modeled post-fire flows
- Threats to human life and property from storm or mudflow and debris

1. Burn Severity

Burn severity is not the same concept as fire intensity and fire severity as recognized by fire behavior specialists. Fire intensity and fire severity relate to fire behavior and fire effects on overstory and understory vegetation, respectively, while burn severity relates specifically to effects of the fire on soil conditions and hydrologic function (e.g., amount of surface litter and duff, erodibility, infiltration rate, runoff response). Although burn severity is not primarily a reflection of fire effects on vegetation, vegetative conditions and pre-fire vegetation density are among indicators used to assess burn severity.

Site indicators used to evaluate and map burn severity include soil hydrophobicity (water repellency), ash depth and color (fire severity), size of residual fuels (fire intensity), and post-fire effective ground cover. These criteria provide clues about fire residence time, depth of litter layer consumed, radiant heat throughout the litter layer and ease of detachability of the surface soil. Using these indicators, burned areas are mapped into three relative burn severity categories -

high, moderate, and low. A category of "unburned" may be mapped separately if there are large unburned islands inside the burn perimeter. Alternatively, mosaics of low and unburned areas may be lumped together for mapping and assessment purposes.

In some cases there may be complete consumption of vegetation by fire, with little effect on soil and watershed function. In general, the denser the pre-fire vegetation and the longer the residence time, the more severe the effects of the fire are on soil hydrologic function. For example, deep ash after a fire usually indicates a deeper litter layer prior to the fire, which generally supports longer residence times. Increased residence time promotes the formation of water-repellent layers at or near the soil surface. The results are increased runoff and soil particle detachment by water and transport off-site (erosion).

A classified satellite image using different spectral wavelength bands to delineate areas of low, moderate, and high burn severity at 30-meter resolution was produced by the Forest Service Remote Sensing Application Center using a Landsat7 image. The burn severity satellite image was verified by field visits, direct soil observations, and helicopter reconnaissance to produce the final burn severity map. The burn severity map becomes a basis to predict the hydrologic response of the watersheds, rates of erosion and the rate of natural revegetation of the site following the fire.

2. Soil Condition

Fire effects were evaluated in terms of soil condition parameters. These parameters included changes in litter and duff (vegetative ground cover), destruction of fine and very fine roots in the surface horizon, susceptibility to erosion, and development of hydrophobic (water repellent) soil surfaces. Changes in vegetative ground cover as affected by the fire were noted and compared to pre-fire conditions. Stability and strength of surface soil structural aggregates ~~was~~ examined. *were* Surface soils were examined for the presence of fine and very fine roots. Water repellency was evaluated by observing the depth and thickness of a water repellent horizon in surface soils where it exists, and the length of time a water drop remained beaded on the surface.

Erosion potential was calculated using the Revised Universal Soil Loss Equation (modified for use on National Forests) in tons/acre in a spatially-based Arcview model. Input data was taken from the Soil Surveys and the White River National Forest and NRCS soils and vegetation GIS layers.

The RUSLE equation was used to calculate expected soil loss:

$$A \text{ (tons/acre)} = R * K * LS * C$$

Where A is the on-site soil loss expected in tons/acre, R is the rainfall factor, K is the soil erodibility value taken from the soil surveys, LS is the slope factor accounting for slope length and step effect, and C is the cover factor. A spatial model (30 meter grid cell size) to predict erosion in tons/acre was run to develop a sense of where the highest erosion potential occurs within the fire and identify candidate areas for hillslope treatments. The model runs a user-specified precipitation event to predict erosion. For the Missionary Ridge Complex, the storm event of concern as a threat to loss of control of water and erosion was a short-duration localized thunderstorm event. The other USLE inputs are incorporated spatially using a Digital Elevation Model (DEM) for the LS factor and by calculating C factors for each different vegetation type in each burn severity class (i.e., a polygon of aspen in moderate burn severity is attributed with a different cover factor than a polygon of aspen in high burn severity).



3. Watershed Response

We considered potential watershed responses to the Missionary Ridge Complex using three approaches: modeling of the magnitude of the sediment-laden flood response, modeling of the magnitude of potential debris flows generated by sediment bulking of storm runoff in channels, and evaluation of the relative landslide risk for the varying geologic units in the area.

a. Potential Flood Response Modeling

On-the-ground field observations and aerial reconnaissance within and downstream of the burn areas were conducted to determine the potential flood response. Channel morphology related to transport and deposition processes were noted, along with channel crossings and stream outlets. Observations included condition of riparian vegetation and the volume of sediment stored in channels and on slopes that could be mobilized. Burn severity and changes in soil infiltration were also considered. Cross-sections were measured at key locations.

To model potential flood events, 50 watersheds that could impact identified values at risk were delineated across the burned area. These watersheds, and their characteristics, are listed in Table 6 — watershed parameters for flood modeling. The flood response of the burned watersheds was modeled using a GIS Rational Method. The model uses a Runoff Curve Number (CN) to calculate time of concentration. The pre-fire and post-fire CN were selected from a CN table based on vegetation types within the Missionary Ridge Complex (Appendix V, Curve Numbers).

Runoff coefficients used in the model (Table 4) were determined from research conducted at experimental plots in the Bitterroot National Forest (Robichaud, 2000). Hydraulic conductivity rates in mm/hr were measured from simulated rainfall events applied several days after a prescribed burn. The simulator rained at a rate of 94 mm/hr on randomly located one meter square plots on natural (unburned), low severity, high severity, and high severity plus strongly hydrophobic soil plots, with three replications. Hydraulic conductivity rates (K) were reported as a range of values but the lowest number in each range for varying burn severity type was used to calculate the runoff coefficient. K values were subtracted from the total simulated rainfall to determine the amount of runoff and then divided by the rainfall rate to calculate percent runoff. Moderately burned areas were extrapolated from the low and high severity values. The post-fire flow factor is a ratio of each severity type runoff rate (mm/hr) to the runoff rate of the unburned condition. Table 3 provides the unburned runoff coefficients.

**Table 3.** Unburned Runoff Coefficients used in the model

Type	Coefficient
Rock/soils	0.50
Grass/forb	0.20
Pinyon juniper	0.20
Sagebrush/other shrubs	0.18
Gambel oak	0.12
Cool moist mixed conifer, Lodgepole pine, Ponderosa pine, Spruce/fir, Warm dry mixed conifer	0.10
Aspen	0.08
Alpine	0.15
Riparian	0.02

Table 4. Runoff Coefficients used in the model.

Plot	K (mm/hr)	Runoff rate (mm/hr)	Post-fire Flow Factor	% Runoff / Runoff coefficient
Natural (unburned)	85	9	1	10/0.10
Low severity	60	34	3.78	36/0.36
Moderate severity	43	52	5.78	55/0.55
High severity with strong hydrophobicity	25	69	7.67	73/0.73

Most post-wildfire floods contain a significant sediment component. Post-fire modeled flows were bulked to account for potential sediment in the flow volume using the following equation:

Pre-fire discharge + (Pre-fire discharge x % high severity burn in watershed x 0.7) + (Pre-fire discharge x % moderate burn severity in watershed x 0.5) + (Pre-fire discharge x % low severity burn in watershed x 0.2) (Table 5 - Burn Severity by Watershed)

Precipitation values for the 30-minute and 1-hour storms used in the flow modeling were acquired from the National Weather Service in Grand Junction, CO. Precipitation values for the 6-hour storms were determined from the NOAA Atlas. Precipitation values used are in Appendix V.

b. Potential Debris Flow Response Modeling

Debris flows are commonly produced from recently burned watersheds. Cannon et al. (2000) found that immediately following a wildfire most debris flows initiate through processes of progressive bulking of storm runoff with material eroded from hillslopes and channels. To identify potential debris flow source areas within the 18 basins previously identified, and to define the stream network through which potential debris flows could move, a stream network was created from a 25 meter Digital Elevation Model (DEM) using the ArcView extension basin1.avx. The minimum accumulation area was set to 60 cells (1500 m²). The resulting network was ordered using the Strahler method (ArcView extension strahler.avx). Stream gradients (maximum, minimum, and

average) were then calculated for all stream segments in degrees and percent using the ArcView extension surftools.avx. All Order 1 streams within areas of moderate and high burn severities with slopes greater than 27° were selected as potential debris flow source areas based on the work of Cannon et al., 2000 (Appendix III, Debris and Flood Hazard Map).

Data from debris flows generated following the 1994 South Canyon fire near Glenwood Springs, Colorado (Cannon et al., 2000) were used to calculate an average rate of debris flow bulking of 8.0 of 8.0 yd³ per linear foot of channel length. These debris flows occurred in geologic units similar to those in the Missionary Ridge fire. The volume of debris flows that could be generated from the 50 basins above the values at risk was determined by multiplying the length of the identified source areas by the bulking factor of 8.0 yd³/ft. Because the debris flows generated from basins burned by the South Canyon were in response to a torrential rainfall, it is necessary to make the same assumption in this approach.

A. Findings

1. Burn Severity and Soil Condition

Table 4 displays a summary of burn severity acres and percentages by severity class for the Missionary Ridge Complex. A burn severity map is included in Appendix III.

Table 4. Burned area and percentage by burn severity

Burn Severity	Acres	Percent
High	22,542	31
Moderate	21,822	30
Low	13,872	19
Unburned	14,728	20
TOTAL	72,964	100

Post-fire soil conditions were reviewed by the BAER soil scientist/ecologist and the San Juan National Forest soil scientist/ecologist. Although only 31 percent of the fire is classified as high severity, several large (300 acres or greater) units of high severity occur over contiguous areas in watersheds of concern. Portions of Coon Creek, Stevens Creek, and slopes west of Vallecito Reservoir and Lemon Reservoir contain these large units of high severity. In these areas, the litter and duff were entirely consumed and little to no protective groundcover exists. Eighteen percent of the Valley Fire, approximately 76 acres out of a total 423 acres, burned at high intensity and exhibits high burn severity. Soils in high burn severity units most commonly exhibited weak water repellency at the surface, with a few isolated inclusions of moderate repellency. The water repellent layer was typically only ½ inch deep, but a few areas that burned at the highest intensity showed a hydrophobic layer up to 1 inch thick. An increase in overland flow due to the hydrophobic conditions is expected and is coupled with increased rates of erosion and increased stream flows. Hydrophobic soil conditions are accounted for in the erosion modeling and hydrologists' peak flow analysis. Hydrophobic layers typically take six months to two years to break down. Plant root development and soil microbial activity contribute to the degradation of hydrophobic conditions. At all points examined in the field, fine roots in the surface horizon were found intact in all classes of burn severity. No soil alteration due to high temperatures was seen including no

changes to soil structure. However, steep slopes examined in Coon Creek and on the east side of the Pine River directly below the Vallecito Dam revealed a very loose surface horizon that is highly susceptible to erosion, and it is likely that this condition occurs on other steep slopes throughout the fire.

Polygons of moderate burn severity exist throughout the entire fire across all vegetation types. In these areas, some leaves or needles remain and will drop to provide protective ground cover that will help reduce runoff velocities, promote infiltration, and mitigate post-fire erosion potential. The litter and duff in these areas was consumed in discontinuous patches. Hydrophobicity is predominately classified as weak with inclusions of moderate and no repellency at the surface in areas of moderate burn severity.

Low severity and unburned polygons also occurred throughout the fire. Large polygons of unburned forest occur at the upper elevations of the western half of the Missionary Ridge Fire and along the eastern and northern perimeters of the east side of the fire. Areas of forest litter and grass may look black immediately post-fire, but in the low burn severity areas the litter and duff was charred but not entirely consumed. This remaining duff provides good ground cover to protect the soil from erosion and runoff. Areas of low severity were tested for water repellency but it was rarely exhibited, and was weak if present. The soil structure was strong, and intact fine and very fine roots were present. Trees in low severity areas are generally mostly green and are expected to survive. Vegetation communities are expected to recover rapidly, and post-fire erosion will not be significantly higher than pre-fire erosion.

Table 5 shows the percentages of burn severity in each watershed. Please refer to the Watershed Analysis Map in Appendix III for watershed locations.

Appendix IV contains photos showing examples of low and high burn severity areas.

See Table 5 on next page.

Table 5. Burn Severity by Watershed

Watershed	Acres	High Severity	Moderate Severity	Low Severity	Burned	Unburned
N4	3	0%	0%	0%	0%	100%
V19	6	0%	0%	0%	0%	100%
N15	7	0%	35%	0%	35%	65%
V24	9	42%	0%	2%	44%	56%
V35	17	53%	5%	0%	58%	42%
N8	19	47%	3%	0%	49%	51%
N6	20	58%	0%	0%	58%	42%
V36	29	57%	10%	2%	69%	31%
N7	30	37%	0%	0%	37%	63%
E12-22	31	70%	2%	0%	72%	28%
V17	32	68%	0%	0%	69%	31%
E36-40	32	63%	17%	4%	84%	16%
V20	33	20%	2%	0%	22%	78%
E2	36	56%	4%	0%	59%	41%
N3	37	29%	0%	11%	40%	60%
N14	77	27%	14%	0%	41%	59%
N13	77	17%	12%	0%	29%	71%
V41	79	43%	8%	3%	54%	46%
N2	79	12%	2%	7%	22%	78%
V34	84	43%	8%	3%	54%	46%
N12	164	26%	0%	0%	27%	73%
NORTH FORK COON CREEK	278	25%	18%	40%	83%	17%
N5	320	49%	2%	0%	51%	49%
E26	354	58%	2%	4%	64%	36%
VALLECITO WEST E3	451	83%	0%	0%	84%	16%
MIDDLE FORK COON CREEK	563	50%	9%	6%	65%	35%
V21	586	29%	15%	0%	44%	56%
V22	596	28%	15%	0%	43%	57%
KROEGER CREEK 2	795	38%	7%	1%	47%	53%
KROEGER CREEK 1	797	38%	7%	1%	47%	53%
WILSON CREEK E23-25	974	17%	13%	36%	66%	34%
X-SECTION NEAR N19	1,023	71%	2%	1%	74%	26%
SOUTH FORK COON CREEK	1,200	37%	12%	31%	80%	20%
E1 JACK CREEK	1,248	79%	1%	5%	84%	16%
E1A	1,250	79%	1%	5%	84%	16%
FREED CANYON	1,379	59%	1%	1%	61%	39%
E4-12	1,487	28%	22%	25%	75%	25%

Table 5. Burn Severity by Watershed (cont.)

Watershed	Acres	High Severity	Moderate Severity	Low Severity	Burned	Unburned
E27-33 TRUE CRE	1,687	19%	18%	22%	58%	42%
N11	3,834	43%	14%	5%	62%	38%
N9	3,834	43%	14%	5%	62%	38%
N10	3,840	43%	14%	5%	62%	38%
N10 X SECTION	3,841	43%	14%	5%	62%	38%
E34 RED CREEK	5,110	14%	14%	26%	55%	45%
N1	5,114	48%	11%	20%	79%	21%
N1 COON CREEK	5,115	48%	11%	20%	79%	21%
LEMON DAM	25,940	2%	8%	15%	25%	75%
FLORIDA ABOVE PRIVATE BRIDGE	35,308	9%	9%	14%	32%	68%
DURANGO H2O SUPPLY	36,731	9%	9%	13%	31%	69%
VALLECITO DAM	46,010	11%	11%	7%	29%	71%
E35 LOS PINOS RIVER	58,563	17%	12%	8%	36%	64%
LOS PINOS RIVER	63,014	17%	11%	8%	37%	63%

2. Erosion Potential

Rilling, gully erosion, and sheet erosion are expected to occur at increased rates due to the fire. In the pre-fire situation, vegetation provided protective groundcover and duff layers played an important role in infiltration; both factors were important for reducing pre-fire overland flow. In the present post-fire situation, soils in high burn severity units are now bare and susceptible to accelerated erosion and increased runoff rates.

It is most important to note the *relative* increase in erosion between pre and post-fire, because of the error associated with the model (due to human inputs such as soil survey information, the burn severity map, and calculations of post-fire cover factors). Some of the areas of highest post-fire erosion show increases in rates of 100 to 1000%, especially where dense stands of vegetation burned with high severity on steep slopes.

3. Watershed Response

The primary watershed response of the Missionary Ridge fire is expected to include: 1) an initial flush of the hillslope mantling ash; 2) rill, sheetwash, and gully erosion on steep hillslopes and in drainages within the burned area; 3) sediment-laden flooding and debris flows and concomitant deposition where stream gradients flatten or at tributary mouths; and 4) increases in peak flows of tributary runoff. Elevated erosion, runoff, and stream flows are expected to occur for several years after the fire until the vegetation has recovered. Recovery of grasses, forbs, and shrubs is expected to occur in most areas within 3 to 5 years. Some areas burned at high severity may not fully recover for ten or more years. Once vegetation has recovered the watershed is expected to return to pre-fire conditions.



Flood hazards

Post-fire time of concentration decreases range from 3 minutes to 1.4 hours (Table 6: Watershed parameters for flood modeling). Post-fire average curve number increases range from none to an increase of 31 (Table 6). Post-fire average runoff coefficient increases range from none to 58% (Table 6).

Post-fire flows were modeled for the 2yr, 5yr, 10yr, 25yr, 50yr, and 100yr 30 minute and 1 hour precipitation events. Results of the flow modeling are described in Table 7: Discharge analysis of flood flows by precipitation event. Post-fire flow increases are predicted for all analysis watersheds (Appendix III, Analysis Watersheds) except N2 and V19.

Based on the results of the discharge analysis there is a high potential for flooding at all values at risk (Appendix III, Analysis Watersheds and Values at Risk). Also, irrigation ditches in the East Animas Valley do not have sufficient capacity to carry post-fire flows as evidenced by flooding that occurred on July 8 (See Photos Appendix IV). Also homes and outbuildings in Animas River Valley, Los Pinos River Valley, and Florida River Valley downstream of the Missionary Ridge Complex are subject to flooding in response to short-duration high intensity precipitation events.

See Table 6 on next page.



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Table 6. Watershed parameters for flood modeling

Watershed	Acres	Pre-Fire Time of Concentration (hrs)	Post-Fire Time of Concentration (hrs)	Average Slope %	Pre-Fire Average Curve Number	Post-Fire Average Curve Number	Pre-Fire Average Runoff Coefficient	Post-Fire Average Runoff Coefficient
N4	3	0.1	0.1	30	61	61	0.10	0.10
V19	6	0.2	0.2	11	64	64	0.20	0.20
N15	7	0.2	0.1	40	60	75	0.11	0.45
V24	9	0.3	0.2	36	60	76	0.11	0.60
V35	17	0.3	0.2	27	72	86	0.10	0.55
N8	19	0.5	0.3	35	59	77	0.10	0.64
N6	20	0.2	0.1	49	70	87	0.10	0.68
V36	29	0.2	0.1	30	67	84	0.10	0.61
N7	30	0.4	0.3	41	65	82	0.10	0.62
E12-22	31	0.7	0.3	33	47	78	0.09	0.67
V17	32	0.3	0.2	45	60	75	0.11	0.64
E36-40	32	0.5	0.3	36	48	73	0.09	0.61
V20	33	0.4	0.3	44	60	75	0.11	0.53
E2	36	0.4	0.2	29	55	75	0.10	0.64
N3	37	0.5	0.3	36	64	80	0.10	0.55
N14	77	0.6	0.4	38	53	73	0.10	0.57
N13	77	0.6	0.3	27	51	73	0.09	0.56
V41	79	0.5	0.4	20	62	77	0.10	0.54
N2	79	0.8	0.7	23	61	64	0.10	0.22
V34	84	0.6	0.4	21	62	77	0.10	0.54
N12	164	0.5	0.3	49	59	78	0.10	0.60
NORTH FORK COON CREEK	278	0.8	0.6	29	56	67	0.12	0.39
N5	320	0.9	0.6	43	61	77	0.10	0.62
E26	354	1.1	0.6	32	49	74	0.10	0.63
VALLECITO WEST E3	451	0.9	0.5	31	61	82	0.10	0.70
MIDDLE FORK COON CREEK	563	1.3	0.7	31	47	74	0.10	0.59
V21	586	0.8	0.5	52	59	75	0.11	0.54
V22	596	0.9	0.6	52	59	75	0.11	0.54
KROEGER CREEK 2	795	1.2	0.7	46	57	76	0.11	0.60
KROEGER CREEK 1	797	1.2	0.7	46	57	76	0.11	0.60
WILSON CREEK E23-25	974	1.6	1.1	33	50	63	0.10	0.39
X-SECTION NEAR N19	1,023	1.3	0.8	50	55	76	0.11	0.66

Table 6. Watershed parameters for flood modeling (cont.)

Watershed	Acres	Pre-Fire Time of Concentration (hrs)	Post-Fire Time of Concentration (hrs)	Average Slope %	Pre-Fire Average Curve Number	Post-Fire Average Curve Number	Pre-Fire Average Runoff Coefficient	Post-Fire Average Runoff Coefficient
SOUTH FORK COON CREEK	1,200	1.7	1.1	32	45	63	0.10	0.45
E1 JACK CREEK	1,248	2.3	1.1	31	46	74	0.09	0.67
E1A	1,250	2.4	1.2	31	46	74	0.09	0.67
FREED CANYON	1,379	1.5	0.9	47	55	76	0.10	0.65
E4-12	1,487	1.7	1.2	40	55	70	0.10	0.44
E27-33 TRUE CRE	1,687	2.1	1.5	35	54	67	0.10	0.42
N11	3,834	1.6	1.0	46	68	84	0.10	0.58
N9	3,834	1.6	1.0	46	68	84	0.10	0.58
N10	3,840	1.6	1.0	46	68	84	0.10	0.58
N10 X SECTION	3,841	1.6	1.0	46	68	84	0.10	0.58
E34 RED CREEK	5,110	2.8	2.0	33	54	67	0.10	0.41
N1	5,114	3.0	1.8	33	49	70	0.10	0.53
N1 COON CREEK	5,115	3.0	1.8	33	49	70	0.10	0.53
LEMON DAM	25,940	5.9	5.5	29	55	57	0.11	0.16
FLORIDA ABOVE PRIVATE BRI	35,308	7.1	6.1	31	55	60	0.11	0.24
DURANGO H2O SUPPLY	36,731	7.4	6.4	31	55	61	0.11	0.24
VALLECITO DAM	46,010	5.8	5.1	35	55	60	0.10	0.23
E35 LOS PINOS RIVER	58,563	7.2	5.9	34	54	62	0.10	0.29
LOS PINOS RIVER	63,014	7.9	6.4	34	55	62	0.10	0.29

Table 7. Discharge analysis for flood flows by precipitation event (Part 1)

Watershed	Acres	Pre-Fire 1yr30min Discharge (cfs)	Post-Fire 1yr30min Discharge (cfs)	1yr30min Bulked Flow (cfs)	Pre-Fire 2yr30min Discharge (cfs)	Post-Fire 2yr30min Discharge (cfs)	2yr30min Bulked Flow (cfs)	Pre-Fire 5yr30min Discharge (cfs)	Post-Fire 5yr30min Discharge (cfs)
N4	3	1	1	1	1	1	1	1	1
V19	6	1	1	1	2	2	2	3	3
N15	7	2	3	3	3	4	5	4	6
V24	9	3	4	6	4	6	8	6	9
V35	17	4	7	10	6	11	15	9	15
N8	19	5	10	13	7	14	18	11	19
N6	20	6	11	15	9	15	21	14	21
V36	29	7	14	20	10	20	29	16	28
N7	30	8	14	18	12	21	26	18	29
E12-22	31	8	15	23	11	22	33	17	31
V17	32	10	16	23	14	23	34	20	32
E36-40	32	8	15	24	12	22	34	18	31
V20	33	10	15	18	15	22	25	21	31
E2	36	9	18	25	13	25	36	19	36
N3	37	10	17	20	14	24	29	21	34
N14	77	21	36	45	31	51	65	45	73
N13	77	17	34	41	26	50	59	39	70
V41	79	15	33	45	23	48	65	36	68
N2	79	16	21	23	25	31	35	37	46
V34	84	17	36	48	25	52	70	39	73
N12	164	52	80	95	76	115	137	110	162
NORTH FORK COON CREEK	278	68	102	137	101	149	199	151	214
N5	320	94	157	212	137	225	304	202	318
E26	354	87	172	245	130	247	352	193	349
VALLECITO WEST E3	451	110	232	367	164	332	526	244	467
MIDDLE FORK COON CREEK	563	138	263	371	206	378	533	307	535
V21	586	193	278	355	282	399	510	409	564
V22	596	195	281	357	285	404	513	414	571
KROEGER CREEK 2	795	244	388	507	358	556	728	523	785
KROEGER CREEK 1	797	245	388	507	359	557	728	524	786
WILSON CREEK E23-25	974	243	369	462	361	535	670	538	767
X-SECTION NEAR N19	1,023	328	524	793	479	751	1,136	697	1,056

Table 7. Discharge analysis for flood flows by precipitation event (Part 1 cont.)

Watershed	Acres	Pre-Fire 1yr30min Discharge (cfs)	Post-Fire 1yr30min Discharge (cfs)	1yr30min Bulked Flow (cfs)	Pre-Fire 2yr30min Discharge (cfs)	Post-Fire 2yr30min Discharge (cfs)	2yr30min Bulked Flow (cfs)	Pre-Fire 5yr30min Discharge (cfs)	Post-Fire 5yr30min Discharge (cfs)
SOUTH FORK COON CREEK	1,200	300	488	673	446	705	973	664	1,006
E1 JACK CREEK	1,248	299	624	978	445	895	1,402	666	1,261
E1A	1,250	299	625	978	446	896	1,403	666	1,263
FREED CANYON	1,379	423	698	992	620	1,001	1,422	905	1,409
E4-12	1,487	416	617	838	614	891	1,210	903	1,270
E27-33 TRUE CRE	1,687	435	666	841	645	964	1,218	957	1,379
N11	3,834	1,157	1,831	2,527	1,698	2,630	3,630	2,481	3,715
N9	3,834	1,157	1,831	2,527	1,698	2,630	3,630	2,481	3,715
N10	3,840	1,159	1,835	2,532	1,701	2,636	3,638	2,485	3,723
N10 X SECTION	3,841	1,159	1,835	2,533	1,701	2,636	3,638	2,486	3,724
E34 RED CREEK	5,110	1,278	1,974	2,416	1,897	2,861	3,501	2,823	4,099
N1	5,114	1,295	2,252	3,226	1,921	3,245	4,648	2,855	4,608
N1 COON CREEK	5,115	1,295	2,252	3,226	1,921	3,245	4,648	2,855	4,608
LEMON DAM	25,940	6,275	6,913	7,481	9,340	10,222	11,062	13,945	15,112
FLORIDA ABOVE PRIVAT	35,308	8,688	10,794	12,275	12,916	15,829	18,000	19,249	23,107
DURANGO H2O SUPPLY	36,731	9,008	11,166	12,652	13,395	16,379	18,560	19,970	23,921
VALLECITO DAM	46,010	11,852	14,563	16,688	17,565	21,314	24,425	26,057	31,019
E35 LOS PINOS RIVER	58,563	15,040	19,969	23,800	22,294	29,111	34,695	33,082	42,107
LOS PINOS RIVER	63,014	16,019	21,371	25,495	23,761	31,164	37,177	35,295	45,095

Table 7. Discharge analysis for flood flows by precipitation event (Part 2)

Watershed	Acres	Pre-Fire 10yr30min Discharge (cfs)	Post-Fire 10yr30min Discharge (cfs)	10yr30mi n Bulk Flow (cfs)	Pre-Fire 25yr30min Discharge (cfs)	Post-Fire 25yr30min Discharge (cfs)	25yr30mi n Bulk Flow (cfs)	Pre-Fire 50yr30min Discharge (cfs)	Post-Fire 50yr30mi n Discharge
N4	3	2	3	3	3	3	3	3	3
V19	6	5	7	7	5	5	5	6	6
N15	7	6	9	11	7	9	11	8	10
V24	9	9	14	18	10	14	19	11	16
V35	17	14	25	35	15	25	34	17	27
N8	19	17	29	40	19	31	41	22	34
N6	20	21	31	44	23	34	47	26	37
V36	29	24	44	65	28	45	66	31	49
N7	30	28	45	57	32	47	59	35	51
E12-22	31	26	47	70	30	49	74	33	54
V17	32	31	48	71	35	51	75	39	56
E36-40	32	28	48	73	32	50	77	36	55
V20	33	33	48	56	36	50	57	41	55
E2	36	30	55	77	34	57	80	38	63
N3	37	33	54	66	37	55	67	41	60
N14	77	70	113	142	79	117	147	88	128
N13	77	62	113	134	70	114	134	79	125
V41	79	58	115	155	66	111	150	74	122
N2	79	60	96	106	68	80	89	77	90
V34	84	62	123	166	71	119	161	80	131
N12	164	167	245	291	187	259	308	207	284
NORTH FORK COON CREEK	278	236	371	498	267	354	475	298	391
N5	320	308	482	652	346	507	685	385	555
E26	354	302	534	762	342	557	794	382	610
VALLECITO WEST E3	451	383	700	1,109	433	742	1,175	484	811
MIDDLE FORK COON CREEK	563	480	836	1,178	542	858	1,210	607	941
V21	586	617	856	1,093	690	904	1,154	764	991
V22	596	624	868	1,104	698	915	1,164	774	1,003
KROEGER CREEK 2	795	795	1,188	1,554	890	1,253	1,639	989	1,372
KROEGER CREEK 1	797	796	1,190	1,556	892	1,255	1,641	990	1,374
WILSON CREEK E23-25	974	840	1,289	1,616	948	1,266	1,588	1,060	1,397
X-SECTION NEAR N19	1,023	1,054	1,562	2,363	1,180	1,676	2,536	1,308	1,833

Table 7. Discharge analysis for flood flows by precipitation event (Part 2 cont.)

Watershed	Acres	Pre-Fire 10yr30min Discharge (cfs)	Post-Fire 10yr30min Discharge (cfs)	10yr30mi n Bulk Flow (cfs)	Pre-Fire 25yr30min Discharge (cfs)	Post-Fire 25yr30min Discharge (cfs)	25yr30mi n Bulk Flow (cfs)	Pre-Fire 50yr30min Discharge (cfs)	Post-Fire 50yr30mi n Discharge
SOUTH FORK COON CRE	1,200	1,036	1,640	2,264	1,170	1,644	2,271	1,308	1,810
E1 JACK CREEK	1,248	1,046	1,905	2,984	1,183	2,008	3,144	1,325	2,197
E1A	1,250	1,047	1,908	2,986	1,184	2,010	3,146	1,326	2,199
FREED CANYON	1,379	1,376	2,099	2,983	1,542	2,239	3,182	1,712	2,449
E4-12	1,487	1,389	2,054	2,790	1,562	2,070	2,812	1,739	2,277
E27-33 TRUE CRE	1,687	1,488	2,293	2,896	1,678	2,263	2,858	1,874	2,492
N11	3,834	3,779	5,748	7,934	4,239	5,946	8,208	4,708	6,514
N9	3,834	3,779	5,748	7,934	4,239	5,946	8,208	4,708	6,514
N10	3,840	3,786	5,759	7,949	4,246	5,959	8,224	4,716	6,527
N10 X SECTION	3,841	3,786	5,761	7,950	4,247	5,960	8,226	4,717	6,529
E34 RED CREEK	5,110	4,409	6,916	8,464	4,980	6,745	8,255	5,568	7,434
N1	5,114	4,450	7,355	10,535	5,024	7,450	10,672	5,615	8,180
N1 COON CREEK	5,115	4,450	7,355	10,535	5,024	7,451	10,672	5,615	8,180
LEMON DAM	25,940	21,878	29,293	31,701	24,744	26,360	28,526	27,697	29,406
FLORIDA ABOVE PRIVAT	35,308	30,128	42,556	48,392	34,052	39,391	44,792	38,092	43,737
DURANGO H2O SUPPLY	36,731	31,271	44,281	50,176	35,348	40,816	46,250	39,547	45,329
VALLECITO DAM	46,010	40,523	55,212	63,271	45,719	52,587	60,263	51,061	58,323
E35 LOS PINOS RIVER	58,563	51,471	73,325	87,390	58,076	70,568	84,104	64,870	78,076
LOS PINOS RIVER	63,014	54,991	79,096	94,358	62,074	75,637	90,233	69,359	83,700

**Table 7.** Discharge analysis for flood flows by precipitation event (Part 3)

Watershed	Acres	Pre-Fire 100yr30mi n Discharge	Post-Fire 100yr30mi n Discharge	100yr30m in Bulked Flow (cfs)
N4	3	3	3	3
V19	6	7	7	7
N15	7	9	12	14
V24	9	13	18	24
V35	17	21	32	45
N8	19	26	40	53
N6	20	31	43	60
V36	29	38	58	85
N7	30	42	60	76
E12-22	31	40	63	95
V17	32	47	65	96
E36-40	32	43	64	98
V20	33	49	65	74
E2	36	47	73	103
N3	37	50	71	87
N14	77	107	151	189
N13	77	97	147	174
V41	79	92	145	195
N2	79	95	109	121
V34	84	99	155	209
N12	164	249	333	395
NORTH FORK COON CRE	278	364	465	625
N5	320	465	652	880
E26	354	466	716	1,021
VALLECITO WEST E3	451	591	950	1,504
MIDDLE FORK COON CRI	563	740	1,107	1,561
V21	586	916	1,165	1,487
V22	596	928	1,180	1,500
KROEGER CREEK 2	795	1,190	1,612	2,108
KROEGER CREEK 1	797	1,192	1,614	2,110
WILSON CREEK E23-25	974	1,292	1,662	2,083
X-SECTION NEAR N19	1,023	1,570	2,147	3,249

**Table 7.** Discharge analysis for flood flows by precipitation event (Part 3 cont.)

SOUTH FORK COON CRE	1,200	1,594	2,145	2,962
E1 JACK CREEK	1,248	1,618	2,576	4,034
E1A	1,250	1,620	2,579	4,037
FREED CANYON	1,379	2,061	2,871	4,080
E4-12	1,487	2,105	2,695	3,661
E27-33 TRUE CRE	1,687	2,279	2,959	3,737
N11	3,834	5,673	7,657	10,569
N9	3,834	5,673	7,657	10,569
N10	3,840	5,683	7,673	10,590
N10 X SECTION	3,841	5,684	7,675	10,592
E34 RED CREEK	5,110	6,784	8,835	10,812
N1	5,114	6,836	9,655	13,830
N1 COON CREEK	5,115	6,837	9,655	13,830
LEMON DAM	25,940	33,816	35,693	38,626
FLORIDA ABOVE PRIVAT	35,308	46,460	52,661	59,883
DURANGO H2O SUPPLY	36,731	48,244	54,596	61,864
VALLECITO DAM	46,010	62,105	70,084	80,314
E35 LOS PINOS RIVER	58,563	78,915	93,425	111,346
LOS PINOS RIVER	63,014	84,428	100,184	119,516

Table 7. Discharge analysis for flood flows by precipitation event (Part 4)

Watershed	Acres	Pre-Fire 1yr1hr Discharge (cfs)	Post-Fire 1yr1hr Discharge (cfs)	1yr1hr Bulked Flow (cfs)	Pre-Fire 2yr1hr Discharge (cfs)	Post-Fire 2yr1hr Discharge (cfs)	2yr1hr Bulked Flow (cfs)	Pre-Fire 5yr1hr Discharge (cfs)	Post-Fire 5yr1hr Discharge (cfs)	5yr1hr Bulked Flow (cfs)
N4	3	0	0	0	1	1	1	1	1	1
V19	6	1	1	1	1	1	1	2	2	2
N15	7	1	2	2	2	3	3	2	4	4
V24	9	2	3	4	2	4	5	3	6	7
V35	17	3	5	7	4	7	10	5	10	13
N8	19	4	7	9	5	9	12	7	12	16
N6	20	4	8	11	6	10	14	8	14	19
V36	29	5	10	14	7	13	19	9	18	26
N7	30	6	10	13	8	14	17	11	19	23
E12-22	31	5	11	16	7	15	22	10	20	30
V17	32	7	11	17	9	15	22	12	20	30
E36-40	32	6	11	17	8	15	23	11	20	30
V20	33	7	11	12	9	15	17	13	20	23
E2	36	6	13	18	8	17	24	11	23	32
N3	37	7	12	15	9	16	20	13	22	26
N14	77	15	25	32	20	34	43	27	46	58
N13	77	12	25	29	17	33	39	23	45	53
V41	79	11	24	32	15	32	43	21	43	58
N2	79	11	15	16	16	20	22	22	28	31
V34	84	12	25	34	16	34	46	22	46	62
N12	164	36	57	68	49	77	91	67	103	123
NORTH FORK COON CREEK	278	48	72	97	65	98	131	90	133	178
N5	320	66	112	151	89	150	203	122	202	274
E26	354	61	123	175	83	165	235	115	222	316
VALLECITO WEST E3	451	77	165	262	105	222	352	145	299	473
MIDDLE FORK COON CREEK	563	97	187	264	132	252	355	182	340	479
V21	586	137	198	253	185	266	339	252	359	458
V22	596	138	200	254	187	269	342	255	363	461
KROEGER CREEK 2	795	172	276	361	233	371	485	320	500	654
KROEGER CREEK 1	797	173	277	362	234	371	485	320	501	654
WILSON CREEK E23-25	974	171	261	328	232	352	442	321	479	600
X-SECTION NEAR N19	1,023	232	374	565	313	501	758	428	675	1,021

Table 7. Discharge analysis for flood flows by precipitation event (Part 4 cont.)

Watershed	Acres	Pre-Fire 1yr1hr Discharge (cfs)	Post-Fire 1yr1hr Discharge (cfs)	1yr1hr Bulked Flow (cfs)	Pre-Fire 2yr1hr Discharge (cfs)	Post-Fire 2yr1hr Discharge (cfs)	2yr1hr Bulked Flow (cfs)	Pre-Fire 5yr1hr Discharge (cfs)	Post-Fire 5yr1hr Discharge (cfs)	5yr1hr Bulked Flow (cfs)
SOUTH FORK COON CREEK	1,200	211	346	478	287	466	644	396	632	872
E1 JACK CREEK	1,248	209	445	697	285	597	936	395	805	1,260
E1A	1,250	209	446	697	285	598	936	395	806	1,261
FREED CANYON	1,379	298	498	707	404	668	949	553	899	1,278
E4-12	1,487	293	438	595	397	590	801	546	799	1,085
E27-33 TRUE CRE	1,687	305	473	597	415	637	804	573	864	1,091
N11	3,834	816	1,304	1,800	1,105	1,752	2,418	1,513	2,362	3,260
N9	3,834	816	1,304	1,800	1,105	1,752	2,418	1,513	2,362	3,260
N10	3,840	817	1,307	1,804	1,107	1,755	2,423	1,516	2,367	3,267
N10 X SECTION	3,841	817	1,308	1,805	1,107	1,756	2,423	1,516	2,368	3,268
E34 RED CREEK	5,110	896	1,401	1,714	1,219	1,887	2,310	1,684	2,562	3,135
N1	5,114	908	1,602	2,295	1,235	2,154	3,085	1,705	2,911	4,170
N1 COON CREEK	5,115	908	1,602	2,295	1,235	2,154	3,085	1,705	2,911	4,170
LEMON DAM	25,940	4,394	4,856	5,255	5,985	6,597	7,139	8,282	9,086	9,832
FLORIDA ABOVE PRIVATE	35,308	6,086	7,614	8,658	8,288	10,309	11,723	11,458	14,112	16,047
DURANGO H2O SUPPLY	36,731	6,310	7,875	8,923	8,593	10,664	12,083	11,882	14,601	16,544
VALLECITO DAM	46,010	8,316	10,281	11,782	11,309	13,910	15,941	15,600	19,015	21,790
E35 LOS PINOS RIVER	58,563	10,552	14,126	16,836	14,351	19,081	22,741	19,799	26,008	30,997
LOS PINOS RIVER	63,014	11,235	15,116	18,032	15,284	20,420	24,361	21,097	27,839	33,211

Table 7. Discharge analysis for flood flows by precipitation event (Part 5)

Watershed	Acres	Pre-Fire 10yr1hr Discharge (cfs)	Post-Fire 10yr1hr Discharge (cfs)	10yr1hr Bulked Flow (cfs)	Pre-Fire 25yr1hr Discharge (cfs)	Post-Fire 25yr1hr Discharge (cfs)	25yrhr Bulked Flow (cfs)	Pre-Fire 50yr1hr Discharge (cfs)	Post-Fire 50yr1hr Discharge (cfs)	50yr1hr Bulked Flow (cfs)
N4	3	1	1	1	1	1	1	2	2	2
V19	6	2	2	2	3	3	3	3	3	3
N15	7	3	4	5	4	5	6	4	6	7
V24	9	4	7	9	5	8	11	6	10	12
V35	17	6	12	17	8	14	20	9	16	23
N8	19	8	15	20	10	18	24	12	21	28
N6	20	10	17	23	12	20	28	15	23	32
V36	29	12	22	32	14	26	38	17	30	44
N7	30	14	23	29	17	27	34	20	31	40
E12-22	31	13	24	36	15	29	43	18	33	50
V17	32	16	25	37	19	30	44	22	34	51
E36-40	32	14	24	37	17	29	44	20	33	51
V20	33	16	24	28	20	29	33	23	33	38
E2	36	14	28	39	17	33	47	21	38	54
N3	37	16	26	32	19	31	38	23	37	45
N14	77	34	57	71	42	67	85	49	78	98
N13	77	29	55	65	36	65	77	43	76	89
V41	79	26	53	71	32	63	85	39	74	99
N2	79	28	35	39	34	42	47	41	50	56
V34	84	28	57	77	35	68	92	42	79	107
N12	164	84	127	151	101	150	179	119	174	207
NORTH FORK COON CREEK	278	113	164	221	138	197	264	164	230	309
N5	320	153	248	335	185	294	398	218	341	461
E26	354	145	272	388	176	323	460	210	374	533
VALLECITO WEST E3	451	183	366	580	223	434	687	266	501	794
MIDDLE FORK COON CREEK	563	230	417	588	280	495	698	334	575	810
V21	586	313	440	562	377	523	667	443	606	774
V22	596	317	445	566	381	529	672	448	613	780
KROEGER CREEK 2	795	398	613	802	480	728	952	566	843	1,102
KROEGER CREEK 1	797	399	614	803	481	728	952	567	844	1,103
WILSON CREEK E23-25	974	403	592	742	491	708	888	585	827	1,037
X-SECTION NEAR N19	1,023	532	827	1,251	641	979	1,482	754	1,133	1,714

Table 7. Discharge analysis for flood flows by precipitation event (Part 5 cont.)

Watershed	Acres	Pre-Fire 10yr1hr Discharge (cfs)	Post-Fire 10yr1hr Discharge (cfs)	10yr1hr Bulked Flow (cfs)	Pre-Fire 25yr1hr Discharge (cfs)	Post-Fire 25yr1hr Discharge (cfs)	25yrhr Bulked Flow (cfs)	Pre-Fire 50yr1hr Discharge (cfs)	Post-Fire 50yr1hr Discharge (cfs)	50yr1hr Bulked Flow (cfs)
SOUTH FORK COON CREEK	1,200	498	779	1,076	607	930	1,284	722	1,084	1,497
E1 JACK CREEK	1,248	498	986	1,545	608	1,169	1,831	725	1,354	2,120
E1A	1,250	498	987	1,545	608	1,171	1,832	726	1,355	2,121
FREED CANYON	1,379	689	1,102	1,566	832	1,306	1,856	980	1,511	2,148
E4-12	1,487	683	984	1,337	828	1,174	1,595	980	1,368	1,857
E27-33 TRUE CRE	1,687	720	1,066	1,346	875	1,274	1,609	1,040	1,486	1,877
N11	3,834	1,887	2,899	4,001	2,279	3,442	4,750	2,688	3,990	5,507
N9	3,834	1,887	2,899	4,001	2,279	3,442	4,750	2,688	3,990	5,507
N10	3,840	1,890	2,905	4,010	2,282	3,449	4,760	2,692	3,998	5,518
N10 X SECTION	3,841	1,890	2,906	4,011	2,283	3,450	4,761	2,693	3,999	5,520
E34 RED CREEK	5,110	2,118	3,164	3,872	2,581	3,783	4,630	3,072	4,418	5,407
N1	5,114	2,144	3,582	5,130	2,611	4,263	6,106	3,105	4,955	7,098
N1 COON CREEK	5,115	2,144	3,582	5,130	2,611	4,263	6,106	3,106	4,955	7,098
LEMON DAM	25,940	10,435	11,393	12,329	12,738	13,838	14,976	15,188	16,419	17,769
FLORIDA ABOVE PRIVATE BRIDGE	35,308	14,423	17,587	19,999	17,591	21,227	24,138	20,956	25,026	28,457
DURANGO H2O SUPPLY	36,731	14,960	18,200	20,623	18,248	21,972	24,897	21,742	25,911	29,360
VALLECITO DAM	46,010	19,593	23,664	27,118	23,840	28,517	32,680	28,334	33,570	38,470
E35 LOS PINOS RIVER	58,563	24,870	32,273	38,463	30,265	38,771	46,208	35,975	45,498	54,225
LOS PINOS RIVER	63,014	26,513	34,552	41,219	32,281	41,518	49,530	38,392	48,732	58,135

**Table 7.** Discharge analysis for flood flows by precipitation event (Part 6)

Watershed	Acres	Pre-Fire 100yr1hr Discharge (cfs)	Post-Fire 100yr1hr Discharge (cfs)	100yr1hr Bulked Flow (cfs)
N4	3	2	2	2
V19	6	4	4	4
N15	7	5	7	8
V24	9	7	11	14
V35	17	11	19	26
N8	19	14	24	32
N6	20	17	26	36
V36	29	20	34	50
N7	30	23	36	45
E12-22	31	21	38	57
V17	32	26	39	58
E36-40	32	23	38	58
V20	33	27	38	44
E2	36	24	44	62
N3	37	27	42	50
N14	77	57	89	112
N13	77	50	86	102
V41	79	46	84	113
N2	79	48	58	64
V34	84	50	90	121
N12	164	138	198	235
NORTH FORK COON CREEK	278	192	265	334
N5	320	253	388	524
E26	354	246	426	604
VALLECITO WEST E3	451	311	570	902
MIDDLE FORK COON CREEK	563	390	655	915
V21	586	511	691	881
V22	596	517	699	888
KROEGER CREEK 2	795	655	959	1,253
KROEGER CREEK 1	797	656	960	1,254
WILSON CREEK E23-25	974	684	950	1,122
X-SECTION NEAR N19	1,023	871	1,287	1,946

**Table 7.** Discharge analysis for flood flows by precipitation event (Part 6 cont.)

Watershed	Acres	Pre-Fire 100yr1hr Discharge (cfs)	Post-Fire 100yr1hr Discharge (cfs)	100yr1hr Bulked Flow (cfs)
SOUTH FORK COON CREEK	1,200	844	1,241	1,635
E1 JACK CREEK	1,248	849	1,539	2,397
E1A	1,250	850	1,541	2,398
FREED CANYON	1,379	1,135	1,718	2,438
E4-12	1,487	1,139	1,564	2,047
E27-33 TRUE CRE	1,687	1,214	1,703	2,077
N11	3,834	3,114	4,543	6,224
N9	3,834	3,114	4,543	6,224
N10	3,840	3,119	4,553	6,236
N10 X SECTION	3,841	3,120	4,554	6,238
E34 RED CREEK	5,110	3,589	5,067	5,936
N1	5,114	3,626	5,657	7,882
N1 COON CREEK	5,115	3,626	5,657	7,881
LEMON DAM	25,940	17,774	19,126	20,132
FLORIDA ABOVE PRIVATE	35,308	24,503	28,973	32,137
DURANGO H2O SUPPLY	36,731	25,427	30,005	33,192
VALLECITO DAM	46,010	33,057	38,807	43,894
E35 LOS PINOS RIVER	58,563	41,979	52,436	61,659
LOS PINOS RIVER	63,014	44,821	56,176	66,079



b. Debris flow, Landslide and Rockfall Hazards.

Our effort to model the potential magnitude of debris flows generated from the basins above the identified values at risk resulted in estimates of volumes between 7,267 and 521,943 yd³ (Appendix III, Flood and Debris Flow Hazard Map, Table 8: Sediment delivery from potential debris flow source areas). In the event of a torrential rainstorm, Coon Creek and Steven's Creek are predicted to produce debris flows in excess of 500,000 yd³.

Debris flows that initiate through the processes of progressive bulking of runoff with sediment eroded from hillslopes and channels, as shown in this map, occur in response to high intensity rainfall over durations of tens of minutes to a few hours. These debris flows are more likely to occur in the months immediately after the fire (Cannon, 2000).

In addition, it is also possible that debris flows that occur by mobilization of shallow (2-6 ft), discrete landslides may also occur in the area burned by the Missionary Ridge fire. This type of debris flow occurs in response to intense periods of rainfall over longer time periods, and is more likely to occur over a longer time frame as soil cohesion decreases with root decay. The Morrison, Cutler, Hermosa, and Eolus Formations have been identified as particularly susceptible to this hazard.

Further, field and aerial photographic reconnaissance identified landslides that have moved from hillslopes into many of the valleys, including Coon Creek and Stevens Creek, in the recent past. These landslide deposits can pose a significant hazard to downstream values at risk in that the deposits can potentially be destabilized by erosion of their toes by the expected high peak discharges moving through the tributary drainages.

Rockfalls also pose a hazard following wildfires. Rocks that were previously buttressed by trees and roots that are now burned may roll down hillslopes. This hazard is particularly prevalent in the Dakota, Hermosa, and Junction Creek Formations formation.

See Table 8 next page.

**Table 8.** Sediment delivery from potential debris flow source areas

Watershed	Debris Flow Source Area (ft)	Potential Sediment Delivery From Debris Flow Source Areas yd ³
N4	-	-
V19	-	-
N15	-	-
V24	-	-
V35	-	-
N8	8,628	69,205
N6	4,320	34,653
V36	3,842	30,819
N7	7,273	58,340
E12-22	3,019	24,217
V17	906	7,267
E36-40	-	-
V20	-	-
E2	-	-
N3	10,787	86,526
N14	4,826	38,711
N13	-	-
V41	-	-
N2	-	-
V34	-	-
N12	2,546	20,425
NORTH FORK COON CREEK	3,477	27,887
N5	5,680	45,561
E26	8,931	71,640
VALLECITO WEST E3	11,639	93,361
MIDDLE FORK COON CREEK	3,815	30,605
V21	5,369	43,063
V22	5,369	43,063
KROEGER CREEK 2	10,233	82,084
KROEGER CREEK 1	10,233	82,084
WILSON CREEK E23-25	4,763	38,206
X-SECTION NEAR N19	17,688	141,886
SOUTH FORK COON CREEK	14,620	117,270
E1 JACK CREEK	3,661	29,364
E1A	3,661	29,364
FREED CANYON	39,664	318,158
E4-12	7,490	60,076
E27-33 TRUE CRE	5,279	42,348
N11	64,553	517,800
N9	64,553	517,800
N10	64,553	517,800
N10 X SECTION	64,553	517,800

Table 8. Sediment delivery from potential debris flow source areas (cont.)

Watershed	Debris Flow Source Area (ft)	Potential Sediment Delivery From Debris Flow Source Areas yd ³
E34 RED CREEK	26,847	215,347
N1	65,069	521,943
N1 COON CREEK	65,069	521,943
LEMON DAM	8,836	70,879
FLORIDA ABOVE PRIVATE BRIDGE	88,171	707,254
DURANGO H2O SUPPLY	88,924	713,291
VALLECITO DAM	226,215	1,814,555
E35 LOS PINOS RIVER	344,557	2,763,818
LOS PINOS RIVER	352,966	2,831,265

c. Water Quality

Changes in water quality parameters such as pH, suspended sediment, and turbidity will occur in all analysis watersheds within and downstream of the Missionary Ridge Complex. Three domestic water supply intakes are located downstream of the fire area (City of Bayfield, City of Durango, and Southern Ute Reservation). The intakes will be impacted by increases in suspended sediment and turbidity causing possible disruptions in water delivery to domestic and municipal users.

5. Values at Risk

Values at risk from erosion, flood or debris flows include human life, safety, and property, and critical cultural and natural resources. Property values can include houses, outbuildings, and roads. Critical cultural and natural resources can include archaeological sites, historical sites, range improvements and critical wildlife habitat. Teams comprised of individuals from the U. S. Forest Service, Natural Resources Conservation Service, and the State of Colorado Division of Forestry assessed property values at risk within and downstream of the Valley fire and the Missionary Ridge fire. Risk categories were high, moderate and low. Risk categories were assigned based on the location of the value at risk to watersheds that experienced high burn severity, had steep slopes and little vegetative ground cover left after the fire. Due to the high number of values at risk in and downstream of the two fires, the team focused on identifying those values that were readily identifiable as high risk (Table 9, this table does not include all of the values at risk. Values in proximity to those listed in the table may also be at high, moderate or low risk of erosion, flood or debris flows. Most of the values listed in the table were modeled using the GIS rational method as explained in the watershed response section of this report. See Appendix III, Values at Risk map.

**Table 9. Missionary Ridge Complex values at risk**

MAP ID	VALUE AT RISK	POTENTIAL FLOOD/DEBRIS FLOWRISK	RISK PROCESS
N1	Residence below Coon Creek	High	Flood flows could damage house
N2	Amimas ditch at confluence with Coon Creek	Low	Flood/debris flows could clog irrigation ditch with debris and divert flow to adjacent fields
N3	Residences	Low	Ash/mud/debris flows
N4	Residences	Low	Ash/mud/debris flows
N5	Residences	Low	Ash/mud sheetflow
N6	Residence	Moderate	Ash/mud sheetflow, debris flow
N7	Residence below Stevens Creek	Low	Ash/mud sheetflow, flooding from irrigation ditch on north side of house
N9	Residence below Stevens Creek	High	Flood flows and debris could damage house
N8	Residence	Moderate	Flood flows and debris could damage house
N10	Residences	Moderate	Ash/mud sheetflow
N11	Residence below Stevens Creek, culvert on access road (house burned)	High	Flood flows and debris flow could damage culvert
N12	Commercial buildings, roads, water supply	High	Flood flows and debris flow could damage commercial property
N13	Access road to 3 burned residences	Moderate	Flood flows and debris flow could damage 18" culvert grated too small
N14	Access road to residences	Low	Flood flows could damage 12" culvert grated too small
N15	Residence	High	Channel capacity reduced by diverting out of natural channel. Flood flow and debris could overtop north branch of Kroeger Creek
KROEGER CREEK 1	Residences on alluvial fan at base of Kroeger Canyon	High	Flood flows and debris could damage houses
V17	Residences	High	Flood flows, debris flows and rockfall could damage houses and outbuildings

Table 9. Missionary Ridge Complex values at risk (cont.)

X-SECTION NEAR N19	Residences at base of Haflin Canyon	High	Flood flows, debris flows and rockfall could damage houses and outbuildings
V19	Residences and irrigation ditch at base of Haflin Canyon	High	Flood flows and debris could damage irrigation ditch, house and outbuildings
V20	Residence at base of Haflin Canyon	High	Flood flows and debris could damage houses and outbuildings
V21	Residence at base of Woodard Canyon	High	Flood flows and debris could damage houses and outbuildings
V22	Residence and irrigation ditch at base of Woodard Canyon	High	Flood flows and debris could damage irrigation ditch, house and outbuildings
V23	Residence	Moderate	Ash/mud sheetflow could damage house and outbuildings
V24	Residence	Moderate	Sheetflow could damage house, debris could accumulate on driveway
V25	Residence	Moderate	Sheetflow/sediment could damage house
V26	Residence	Low	Flood flows and debris could damage house
E1 JACK CREEK	District building at Jack Creek	Moderate	Flooding, debris flow
VALLECITO WEST E3	Residence	High	Flooding, debris flow, sheet/overland flow, inadequate size culvert, inadequate channel capacity
E4-12	Residences, roads, and water supply	High	Draw south of Buffalo Gap and by Chamber building could flood culverts which are undersized (2@ 48")
E12-22	Residences at Pine River inlet to Vallecito Reservoir	High	Flooding 200' above Pine River inlet to Vallecito Reservoir
WILSON CREEK E23-25	Residences at Wilson Creek, eastside Vallecito Reservoir	High	Flooding
E27-33 TRUE CRE	Seven residences in True Creek area	High	Flooding, debris flow, blocked culverts
E34 RED CREEK	Home in mouth of Red Creek	High	Flooding
V34	Residence and irrigation ditch	High	Flood flows and debris could damage house and irrigation ditch
V35	Residence and irrigation ditch	High	Flood flows and debris could damage irrigation ditch, house and outbuildings
V36	Residence	High	Flood flows and debris could damage house
V41	Residence	Moderate	Flood flows and debris could damage house and outbuilding
V43	Residence and irrigation ditch	Moderate	Flood flows and debris could damage irrigation ditch, house and outbuilding
V42	Irrigation ditch and intersection of CR 252 and CR 203	Moderate	Flood flows and debris could damage irrigation ditch and spill over onto road at intersection

Table 9. Missionary Ridge Complex values at risk (cont.)

	Red Ridge Road	High	Flood flows and debris could plug undersized culverts and damage road
GRAHAM CAMPGROUND	USFS Campground	Moderate	Ash/mud sheetflow could damage campground facilities
NORTH CANYON CAMPGROUND	USFS Campground	Moderate	Ash/mud sheetflow could damage campground facilities
PINE POINT CAMPGROUND	USFS Campground	Moderate	Ash/mud sheetflow could damage campground facilities
E36-40	Residences	High	Flood flows and debris could damage house and any existing outbuildings
E26	Lemon Dam Spillway	High	Flood flows and debris could clog spillway
E1A	Channel stability	High	Channel at risk of destabilizing as a result of flood and debris flows scouring the channel
LEMON DAM	Reservoir	High	Sedimentation of the reservoir
DURANGO H2O SUPPLY	Water supply	High	Flooding and sedimentation of the water supply
E2	Residence	High	Flood flows and debris could damage house and any existing outbuildings
UTE WATER SUPPLY	Water supply to Ute reservation lands	High	Flooding and sedimentation of the water supply
BAYFIELD WATER SUPPLY	Water supply to Bayfield	High	Flooding and sedimentation of the water supply
FREED CANYON	Residence	High	Flood flows and debris could damage house and any existing outbuildings
FLORIDA RIVER ABOVE PRIVATE BRIDGE	Residences	High	Flood flows and debris could damage houses and any existing outbuildings
VALLECITO DAM	Reservoir	High	Sedimentation of the reservoir
E35 LOS PINOS RIVER	Residences	High	Flood flows and debris could damage houses and any existing outbuildings
LOS PINOS	Residences	High	Flood flows and debris could damage houses and any existing outbuildings
NORTH FORK COON CREEK	Culvert	Moderate	Flood and debris flows could plug undersized culvert
MIDDLE FORK COON CREEK	Culvert	Moderate	Flood and debris flows could plug undersized culvert
SOUTH FORK COON CREEK	Culvert	Moderate	Flood and debris flows could plug undersized culvert

IV. RECOMMENDATIONS

A. FIRE SUPPRESSION REHABILITATION

1. Fire Suppression Rehabilitation was not addressed in this BAER assessment

B. EMERGENCY STABILIZATION

1. Early Warning System

Situation: Individual residences, subdivisions, and commercial facilities are located within and downstream of the Missionary Ridge Complex (Appendix III –Analysis Watersheds and Values at Risk Maps). The watersheds draining to the identified values at risk have an increased potential for creating flooding and debris flow hazards that could endanger the citizens that utilize or inhabit the facilities or residences associated with the values at risk. Proposed ESR treatments cannot protect human life or property from all magnitudes of floods and debris flows. Therefore, residents, employees, and visitors to flood and debris flow prone areas need timely warning in order to evacuate the hazard area.

Recommendation: Install twelve precipitation stations (Appendix III – Early Warning Precipitation Stations Map). These weather stations should be programmed to relay “real-time” weather information to the National Weather Service for use in determining and issuing flood and debris flow watches and warnings.

See Part F, Specification #1: Early Warning System

2. Slump Stabilization Engineering Design

Situation: The toe of the existing landslide feature in Coon Creek could be undercut by increased flows in Coon Creek. If the toe is undercut, landslide debris could dam Coon Creek. If a landslide dam blocks Coon Creek streamflow would be impounded behind the dam. When the dam is breached the water impounded behind the dam will release resulting in severe changes in Coon Creek channel morphology, flooding and possible destruction of the house at the mouth of Coon Creek, and flooding of the Animas Ditch and Animas River and structures adjacent to the ditch and river.

Recommendation: Hire an engineer to complete an evaluation of the need and feasibility of stabilizing the toe of the landslide in Coon Creek.

See Part F, Specification #6: Engineering Assessment and Design to Stabilize Slumps in Drainages.

3. Lemon Spillway Engineering Design

Situation: Watershed E26 drains directly to the emergency spillway of Lemon Reservoir Complex (Appendix III - Analysis Watersheds and Values at Risk Maps). This watershed has the potential to deliver approximately 71,000 cubic yards of sediment and debris to the spillway area and block the spillway.

Recommendation: Hire an engineer to complete a design of a diversion channel to divert debris laden flows away from the emergency spillway.

See Part F, Specification #5: Engineering Design of Diversion Structure at Lemon Reservoir Spillway

4. Log Erosion Barriers

Situation: Areas draining to values at risk including the domestic water supply intakes for the cities of Durango and Bayfield and the Southern Ute Reservation, reservoir storage capacity for Lemon and Vallecito Reservoirs, and several houses and outbuildings could be impacted and damaged by sediment and debris laden flows in the E26 Complex (Appendix III - Analysis Watersheds and Values at Risk Maps). The primary causes of the sediment laden flows are increased risk of surface erosion and debris flow. Treatments for reducing effective slope length and the formation of rill and gully networks should be implemented in moderate and high severity burn areas to increase infiltration and interrupt hydrologic continuity.

Recommendation: The following treatments were considered to increase infiltration and interrupt hydrologic continuity:

- Contour trenching
- Aerial hydromulch
- Contour disking
- Erosion control blankets
- Log erosion barriers

Contour trenching and scarification/ripping was excluded from further consideration because of the difficulty in ensuring that trenches are constructed on the contour. Aerial hydromulching was excluded because it was proven to be ineffective in a high intensity short duration precipitation event following the Cerro Grande Fire in New Mexico. Contour scarification/ripping was excluded because contour scarified/ripped furrows promote noxious weed invasion and viability. Erosion control blankets were excluded because of the high cost.

Log erosion barriers on slopes <40% with adequate road access were selected as the preferred treatment for increasing infiltration and interrupting hydrologic continuity (Appendix III – Hillslope Treatments Map). The slope criteria of <40% is less than the standard slope criteria (<60%) to allow for the use of feller bunchers or other low ground pressure equipment to fell trees. The use of feller bunchers will reduce the safety hazard to chainsaw operators and other personnel assigned to the implementation of log erosion barriers.

See Part F, Specification #2: Log Erosion Barriers

5. Straw Mulching

Situation: Surface erosion and sediment delivery is increased from moderate and high severity areas. Surface erosion, suspended sediment concentrations and turbidity can be reduced by increasing ground cover in areas that are accessible to a straw blower or hand application of straw.

Recommendation: Apply straw mulch to hillside above Lemon Reservoir and Florida River.

See Part F, Specification #4: Straw Mulching above Lemon Reservoir and Florida River



C. MONITORING

1. Helicopter Monitoring of Debris Dams

Situation: High burn severity watershed above the East Animas Valley, E-3 Vallecito West, Jack Creek, Wilson Creek have the potential to create debris jams. If a debris jam blocks streamflow in these watersheds, water could be impounded behind the jam or diverted. When the jam is breached the water impounded behind the dam will release resulting in severe changes in channel morphology, flooding and possible destruction of structures and infrastructure (roads and drainage facilities).

Recommendation: Conduct aerial reconnaissance of debris jam prone watersheds to identify debris jam areas.

See Part F, Specification #7: Helicopter Monitoring of Debris Jams Following Precipitation Events

2. Treatment Effectiveness Monitoring

Situation: Assess the effectiveness of seeding, road, and hillslope treatments in reducing surface erosion and sedimentation, increasing infiltration, and reducing flooding.

Recommendation: Identify sites adjacent to and downstream of treatment areas to monitor precipitation, channel morphology, and peak flows.

See Part F, Specification #27: Treatment Effectiveness Monitoring

D. MANAGEMENT RECOMMENDATIONS (Non-Spec)

1. Prepare a Flood and Debris Flow Emergency Preparedness Alert Plan

Situation: Several areas within and downstream of the burned area are at high risk of flooding and debris flows.

Recommendation: Prepare a plan detailing what conditions will trigger alerts, who will be notified by the alerts, and what actions will occur at each stage of alert. Plan evacuation routes and notify residents and employees of actions they need to take when an alert is triggered. Entities notified when an alert is triggered may include: Sheriff's department, state patrol, fire department, residents, and businesses. We recommend that warnings for evacuations be issued for rainfall accumulations rates of 0.15 inches in 30 minutes or less. This value is based on the results of sprinkling experiments in the Bitterroot National Forest by Robichaud, (2002), where the highest first year post-fire erosion rates were found to accompany rainfall accumulations of 0.04 inches in 10 minutes. We extended the time period, and the total rainfall accumulation, for the warning threshold to 30 minutes based on the results of the discharge analysis, where we found that the minimum time of concentration for the basins above the values at risk was less than or equal to 30 minutes.

2. Manage Range Allotments

Situation: Watersheds where range allotments are located have reduced ground cover (live and dead vegetation, and organic debris). Grazing could inhibit watershed recovery by delaying the availability of live vegetation for canopy cover and organic litter. Also, streams within allotments are susceptible to streambank erosion by increased shear stress associated with post-fire flows because of loss of root strength provided by vegetation that was consumed by or damaged by the fire.

Recommendation: Evaluate ground cover for all allotments within the Missionary Ridge Complex. Focus ground cover evaluations on moderate and high severity burn areas. If ground cover is less than 70% develop an alternative annual operating plan for the upcoming grazing season. Develop a ground cover monitoring plan in coordination with the permittees. Consider excluding grazing on areas where 70% ground cover has not been achieved.

V. CONSULTATIONS

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MISSIONARY RIDGE COMPLEX

CULTURAL RESOURCE ASSESSMENT

I. OBJECTIVES

- Assess damage and potential damage to known cultural resources (archaeological sites, historic sites, cultural landscapes, Areas of Critical Environmental Concern (ACEC), and traditional cultural properties (TCP's)) which are listed on, eligible for, or not evaluated for, nomination to the National Register of Historic Places, from the adverse effects of wildfire, suppression activities, rehabilitation projects, and emergency stabilization activities.
- Develop and implement treatments to stabilize and rehabilitate archaeological sites, historic sites, cultural landscapes, ACEC's, and traditional cultural properties adversely affected by wildfire, fire suppression activities, rehabilitation projects and other emergency stabilization activities.
- Conduct assessments and implement treatments in a manner that meets federal legal requirements

II. ISSUES

- Assessment of impacts to cultural resources by the fire, suppression activities and proposed rehabilitation projects
- Protection of sacred/respected places within the burn areas;
- Evaluation of previously recorded, but unevaluated cultural resources;
- Consulting on effects of the fire, suppression activities, and proposed rehabilitation measures as per the National Historic Preservation Act;
- Reducing effects of erosion upon cultural resources;
- Reducing or avoiding effects to cultural resources during the rehabilitation process;
- Development of treatments to protect, stabilize, and rehabilitate cultural resources

III. OBSERVATIONS

A. Background

Heritage and cultural resources include prehistoric and historic sites, traditional properties, cultural landscapes, and sacred sites. Protection and preservation of these resources are federally mandated under Section 106 of the National Historic Preservation Act of 1966 and Executive Order 11593. Section 110 insures that heritage preservation is fully integrated into all ongoing programs undertaken by federal agencies including, but not limited to, fire suppression and fire rehabilitation activities.

Heritage and cultural resources are considerable, non-renewable, irreplaceable, and unique resources whose presence on federal and state property justifies all reasonable efforts to identify and preserve them in all circumstances. Class I Heritage Resource Sites are defined as those historic and prehistoric resources determined eligible to the National Register of Historic Places (NRHP) per criteria 36CFR60.4. Further, Forest Service Manual (FSM) 2361 direction states the Class II sites,



which are classified as heritage resource sites whose NRHP status is unknown or unevaluated, be afforded the same consideration and protection as Class I sites. Class I and II heritage sites identified during BAER assessments are considered eligible for federal funding under Sections 106 and 110.

Cultural resources are affected by fire and fire related activities in many ways. During the actual burn historic structures and other perishable resources may be consumed well before archaeologists have the chance to formally document those sites. In this instance, historic structures are particularly vulnerable. Fire suppression activities pose a more direct impact to cultural resources, but are far more preventable. The construction of dozer and handlines impact the integrity of archaeological sites through ground disturbance that alters their scientific and cultural value. Removing sediment during those operations often obliterates surface visibility of archaeological sites and alters their subsurface integrity. Heavy equipment use at helipads and bulldozer operations can physically break artifacts and compress the ground surface further altering their scientific and cultural value. Identification of significant cultural resources prior to rehabilitation efforts is equally significant for cultural resource preservation. During rehabilitation ground crews and heavy equipment use pose threats to cultural resources in a similar manner as discussed above. However, failure to identify significant cultural resources prior to rehabilitation efforts may lead to their damage or destruction through the occurrence of natural processes that occur after a fire has consumed significant portions of the vegetation. Flood and debris flow may obliterate or significantly damage historic and prehistoric archaeological sites without mitigating measures.

The area affected by the Missionary Ridge and Valley fires is administered primarily by the San Juan National Forest (SJNF). A total of 62,934 acres of SJNF land is within the area of effect. The fire has consumed all or parts of 5,904 acres of the Weminuche Wilderness. Most of the burned area within the Valley Fire is private land with portions of two SJNF parcels affected. Bureau of Land Management administers 691 acres affected within the boundary of the Missionary Ridge fire. State lands affected by the fire totals 255 acres along with 9,082 acres of private property. Total area affected is 72,962 acres.

The area of effect is located within La Plata County and within the following 7.5 minute quadrangles: Durango East, Hermosa, Mountain View Crest, Lemon Reservoir, Vallecito Reservoir, Ludwig, Baldy Mountain, Granite Peak, and Rules Hill.

During fire suppression activities 103.3 miles of dozer lines were constructed and 14.4 miles of hand lines were constructed. Only a small fraction of these lines were surveyed by a professional archaeologist prior to, during, or after line construction as of this date.

The Missionary Ridge Fire is located on the southern flank of the broad, domal-shaped San Juan uplift. The region is characterized by a thick (3,000 to 4,000 ft) succession of Paleozoic and Mesozoic sedimentary strata dipping between 5 and 25 degrees to the south. The Lower Cretaceous Dakota Sandstone caps much of the ridge. The region contains dramatic variations in elevation and topographic gradient. North to south, down the axis of the ridge, the region is characterized by a relatively gentle gradient, sloping gradually to the south at elevations ranging from 10,500' near Horse Thief Park to 7,500' on the lower Florida River. The east and west boundaries of the region drop rapidly into major south-flowing river systems such as the Animas, Florida, Pine, and Piedra Rivers. These regions contain steep gullies and cliffs, dropping several thousand feet in elevation within 1 to 2 miles (Hooten Personal Communication).

Environmental zones affected by the fire include upper montane forest and even isolated areas of subalpine forest. The fire was contained along most riparian systems. Engelmann, spruce, sub-alpine fir, ponderosa pine, aspen, and Gambel oak are the dominant vegetation for the Missionary Ridge area. Valley Fire vegetation consists of stands of pinon/juniper and ponderosa pine with Gambel oak and mountain mahogany shrubs.



B. Culture History

A recent review of the archaeological resources on the San Juan National Forest was completed by Duke et al. (1998). More comprehensive is a review of archaeological resources for the southern portion of the Colorado River drainage, encompassing southwest Colorado, provided by Lipe et al. (1999). As such, a comprehensive review will not be provided here in lieu of these documents.

The prehistoric chronological framework for the area generally follows that of the Pecos Classification (Plog 1974) and the fine-tuning provided by Eddy et al. (1984), Guthrie et al. (1984), Duke et al. (1998), and Lipe et al. (1999). The culture history for the area is divided into seven general periods: Paleoindian (ca. 11,500 – 5,500 B.C.), Archaic (5,500 – A.D. 1), Basketmaker (400 B.C. – A.D. 700), Pueblo (A.D. 700-1300), Ute (unknown – present), Navajo (unknown – present), and EuroAmerican (A.D. 1765 – present) (Duke et al. 1998).

Occupation of the area during the Paleoindian period is considered ephemeral (Pitblado 1993; York 1991) given the paucity of diagnostic projectile points recovered in the area. Isolated artifacts dating to the Paleoindian period have been recovered, but to date no habitation sites have been identified in the area of effect. Archaic period sites are known from the area, but again are relatively few compared with the Basketmaker and early Pueblo occupations. As of 1997, a total of 197 dated Archaic components were identified for the entire three district San Juan National Forest (Duke et al. 1998). A majority of those sites are located outside of the Columbine District (the district within which the burned area is located).

Much more prevalent for the area of effect are the Basketmaker II and III occupations and the Pueblo I period. The Valley fire affected these site types. Both the Basketmaker and Pueblo period sites may be subsumed under the Ancestral Pueblo or Formative designations. The Animas Valley, separating the well-known Falls Creek Archaeological Area and the Missionary Ridge/southern San Juan Mountains containing the majority of the fire area, was a major locus of Basketmaker and Pueblo I occupation. Some of the earliest archaeological investigations in the Southwest took place within the general area of the Animas River valley centered on Durango, Colorado. Investigations include the work of Earl Morris and area locals such as Zeke Flora who excavated the Falls Creek Rockshelters, type site for the Basketmaker II period, located a short distance southwest of the Valley Fire. A low ridge separating the Hidden and Animas Valleys contains a high density of Formative Stage occupations indicated by artifact scatters and pithouse depressions. The entire Valley Fire was situated along this ridge. Other well-known sites on this ridge include Talus Village, excavated by Morris, which is located directly within the burned area of the Valley Fire, and the Darkmold site, located just south of the southern burn area boundary (Charles, reference incomplete). All of the aforementioned sites date to the Basketmaker II period (400 B.C. – A.D. 450).

The general area of the burn is also the ancestral homeland of the Utes (comprised of at least 11 historic bands of which the Weminuche, Muache, and Capote bands occupied the area of the SJNF). The beginning of Ute presence in the area is a topic of much debate and cannot be considered here. Arguments have centered both on a relatively late arrival, perhaps as late as A.D. 1400, and that of an in-situ occupation beginning perhaps as early as 8000 B.C. The merits of both are discussed in Duke et al. (1998). Material culture remains associated with Ute occupation include conical wickiups, peeled ponderosa pine trees, flaked glass, and Desert side-notched and Cottonwood triangular projectile points. As pointed out by Duke et al. these cultural indicators are by no means unequivocal (1998:10.5-10.6). Culturally peeled ponderosa pine trees are one of the more oft attributed cultural indicators of Ute occupation (Martorano 1988). The intended function of peeled trees most often involves their use as a starvation food or even as birthing trees wherein the trees were used as support and the placenta was buried at the base. Culturally peeled trees are recorded as isolated finds and are therefore ineligible for the National Register of Historic Places (NRHP). In all likelihood a large number of documented and undocumented peeled trees were lost to the fire, including isolated trees located on the east side of Vallecito Reservoir.



Navajo occupation of the SJNF is restricted to the southern portion and well outside the area of effect. It is tacitly assumed, however, that Navajo likely utilized the higher elevations of the forest seasonally or during periods of stress such as the Refugee period of the 17th Century. No known Navajo sites were affected by the fire or fire suppression activities.

EuroAmerican use of the area is well-documented, beginning as early as 1765 with the Spanish and beginning in earnest during the mid-19th Century with discovery of minerals in the San Juan Mountains. The remains of early homesteading, ranching, logging operations, mining, and railroad operations are abundant within the SJNF. Due to the paucity of formal cultural resource inventories within the burn area, few documented historic remains were identified. Many of these resources are located on private property surrounding the Lemon and Vallecito Reservoirs and have not been formally investigated by archaeologists or historians. At the time of this writing an unknown number of historic cultural resources were affected by the fire, located either on private or federal property.

C. Reconnaissance Methodology and Results

On July 5, 2002 an archaeologist was assigned to the BAER team to identify, evaluate, and assess cultural resources affected by the fire or fire related activities. A file search and an incomplete GIS database were used to initially identify sites located within the area of effect. A file search with the Office of Archaeology and Historic Preservation (OAHP) within the 7.5 minute quadrangles comprising the fire is pending. Due to the absence of key personnel and the state of the existing files these initial cultural resource file searches are considered incomplete, but do provide a baseline to begin assessing damage and propose rehabilitation treatments.

An archaeologist was not assigned to the fire until June 25, 2002, 15 days after the start of the fire. Initial fire suppression activities consisted of dozer and hand lines, drop points, helipads, and staging areas, none of which were surveyed by an archaeologist prior to their construction. As a result, it is possible that previously unknown historic or prehistoric cultural resources were destroyed or adversely affected during fire suppression activities.

A limited number of cultural resource inventories have been carried out in the portion of the SJNF affected by the fire and fire related activities. The preliminary file search identified two previously recorded prehistoric archaeological sites eligible for the NRHP (5LP714 and 5LP277). One additional site, Talus Village, is located on private property and was not evaluated. Most sites identified within the burned area were recorded as isolated finds (IF's), consisting primarily of isolated culturally peeled trees or single or small lithic scatters ineligible for the NRHP due to shallow soils and the lack of diagnostic artifacts.

Site 5LP714 was field assessed on July 7, 2002 with a hydrologist to determine potential impacts from erosion. Site 5LP277 was evaluated based solely on its map location given the burn severity and local topography.

On July 10, 2002 the BAER archaeologist and a hydrologist conducted a flyover to assess whether significant cultural resources were visible but otherwise undocumented. Areas were assessed to determine whether flood, debris flow, or other natural processes stemming from the fire would affect documented archaeological sites located outside the burn perimeter.



IV. RECOMMENDATIONS

Management (specifications related)

A. Cultural Resource Damage Assessment - Fire

Of the three previously documented archaeological sites identified, two require further field assessment and documentation of damage sustained during fire and fire related activities. A condition assessment for resource compliance and rehabilitation, if warranted, must be completed. Site 5LP714 and 5LP277 has been determined to require reseeding and monitoring to mitigate further damage from erosion and increased visibility.

B. Monitoring

Each of the two archaeological sites identified as eligible for protection require monitoring to mitigate the processes of erosion over time and their increased visibility from decreased vegetative cover. Monitoring will also evaluate the effectiveness of reseeding and provide a means to reassess rehabilitation efforts.

C. Tribal Consultation

Twenty-seven Native American tribes claim affiliation to the cultural resources within the burned area. Tribes will be notified of the archaeological sites affected by fire and/or fire related activities and the proposed rehabilitation and stabilization of those sites.

Management (non-specifications related)

A. Stabilization – Fire Suppression Rehabilitation

Prior to rehabilitation of dozer and hand lines, consultation with an archaeologist must take place in order to identify areas with previously documented cultural resources. In this case, every effort should take place to survey all dozer and hand lines, helipads, staging areas, or any other area that has sustained ground disturbing activities prior to rehabilitation measures. Such measures will mitigate any further damage or destruction to cultural resources not previously documented. Following survey and documentation, a synthesis of site evaluations and proposed site treatments must be produced. Complete all legal requirements as described under the Historic Preservation Act and other associated laws. Prepare amendments to the BAER report that identify the methods and cost for implementing specific site treatments.

B. A systemic cultural resource inventory should be implemented within those areas of the burned area that have not received previous cultural resource inventories. An inventory should be implemented as soon as possible while ground visibility is improved. It is also recommended that those areas exhibiting topography less than 30 degrees be targeted for survey. High and moderate areas of burn severity should have high priority. These areas will also be the locations for immediate rehabilitation and stabilization efforts. Rehabilitation and stabilization efforts pose immediate hazards to unknown sites. Although no projected site densities are available within the burned area, it is highly likely that a significant number of unknown cultural resources are present. The paucity of cultural resource inventories within the burned area necessitates intensive surveys and is in line with Section 110.

C. The Valley Fire burned area falls within an area of high archaeological site density. It is recommended that private property be included in federal management efforts. The presence of Talus Village, a significant Basketmaker II archaeological site, located on private property,

suggests that other similar archaeological sites may be present on private property. Three hundred and eighty acres were burned at moderate to high intensity levels. These areas pose immediate erosion hazards to unknown or unevaluated archaeological sites such as Talus Village.

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MISSIONARY RIDGE COMPLEX

RANGE RESOURCE ASSESSMENT

I. OBJECTIVES

- Identify fire-damaged range improvement structures.
- Determine where forage has been lost in areas of high burn severity.
- Develop grazing plan for allotments affected by the fire for the next 2 years.
- Identify areas where emergency temporary fences will be needed to protect recovering vegetation from livestock grazing.

II. ISSUES

- Losses of range improvements where the fire burned severely and where suppression efforts took place will negatively affect deferred grazing rotation systems for resource protection.
- Vegetation in severely burned areas may have 100% mortality and will need reseeding to restore forage for wildlife, livestock and proper hydrologic function.
- There are 12 grazing allotments within the burned area. The allotment management plans may need to be modified to reflect the change in terrain and forage availability.
- Some of the allotments have areas of high burn severity. After areas are reseeded, they will need to be protected from livestock grazing.

III. OBSERVATIONS

The Missionary Ridge Complex consists of the Missionary Ridge Fire West, the Missionary Ridge Fire East and the Valley fire. The Valley fire consists mainly of private land, while both Missionary Ridge fires are predominately NFS land. The fire burned into 12 US Forest Service administered grazing allotments of which 11 are cattle allotments and 1 is a sheep allotment. There are 15 term grazing permits issued for these allotments. Many of the allotments burned in a mosaic pattern, which overall did not damage forage values and may have even improved forage in some cases. Some allotments burned severely and may have areas that need deferment from grazing for an undetermined period.



The following tables show lost structures and values according to the time the structures were built. The replacement costs are expected to be much higher, considering present standards and costs.

Haflin Creek C & H

Invent #	Description	Unit	Location	Value
3F	Haflin Falls Drift	.1 mile	Sec 26, T36N, R8W	\$200.00
2F	Stock driveway div. Fence	.2 mile	Sec 36, T36N, R8W	\$400.00
5F	Cliff boundary fence	.75 mile	Sec 35, 36, T36N, R9W	\$1250.00
1F	Baldy Drift fence	.80 mile	Sec 29, 32, T36N, R8W	\$3500.00
12W	Haflin Spring Log Pen	Log trough	Sec 26, T36N, R9W	\$200.00
Total Value				\$5550.00

Red Creek C & H

Invent #	Description	Unit	Location	Value
4W	Guzzler #1	200 gal	Nw/nw sec 21 T36N R8W	\$250.00
5W	Guzzler #2	200 gal	Nw/nw sec 16 T36N R8W	\$250.00
1W	Flood Spring	Tank	Sec 22 T36N R8W	\$250.00
2W	Nelson Spring	Tank	Sec 27 T36N R8W	\$250.00
3W	Nelson Nettle	Tank	Sec 28 T36N R8W	\$250.00
Total Value				\$1250.00



Steven-Shearer C & H

Invent #	Description	Unit	Location	Value
1F	Freed canyon drift fence	.3 mile	Sec 24, T36N, R9W	\$400.00
2F	Kroeger canyon drift fence	.4 mile	Sec 24, T36N, R9W	\$600.00
3F	Shearer/Elkhorn division fence	2.25 miles	Sec 2, 3, 12 T36N, R8W	\$4000.00
4F	Stevens Upper/lower division fence	.2 mile	Sec 8 T36N, R8W	\$2400.00
1W	Freed canyon spring #1	Wood trough	Sec 19 T36N, R8W	\$400.00
2W	First Fork Spring #1	Tank	Sec 19 T36N, R8W	\$400.00
3W	Freed Canyon Spring #2	Tank	Sec 19 T36N, R8W	\$400.00
4W	First Fork Spring #1	Tank	Sec 19 T36N, R8W	\$400.00
5W	Cabin Fork Spring #2	Tank	Sec 20, T36N, R8W	\$400.00
6W	Cabin Fork Spring #3	Tank	Sec 20 T36N, R8W	\$400.00
12W	E. Shearer Spring Tanks	2 Tanks	Sec 2, 11 T36N, R9W	\$700.00
16W	Stevens/Elkhorn Spring	Tank	Sec 6 T36N, R8W	\$600.00
10W	Grouse Guzzler	Guzzler	Sec 1 T36N, R9W	\$700.00
11W	Antler Guzzler	Guzzler	Sec 1 T36N, R9W	\$800.00
Total Value				\$12,600.00

Elkhorn C & H

Invent #	Description	Unit	Location	Value
9W	Elkhorn Guzzler	Guzzler	Sec 6, T36N, R8W	\$700.00
10W	Elkhorn/Stevens Spring	Tank	Sec 6, T36N, R8W	\$500.00
2F	Elkhorn-Stevens fence	1.6 miles	Sec 3, 9, 10 T36N, R8W	\$1200.00
4F	Coon Creek/Elkhorn fence	1.0 mile	Sec 34, T37N, R8W	\$2400.00
Total Value				\$4800.00



Coon Creek C & H

Invent #	Description	Unit	Location	Value
1F	Coon Creek drift fence sec 1	1.8 miles	Sec 15, 22 T37N, R8W	\$18,000.00
2F	Coon Creek drift fence sec 2	.4 mile	Sec 27, T37N, R8W	\$300.00
4F	Elkhorn-Coon Creek let down	1.0 mile	Sec 27, 34 T37N, R8W	\$2400.00
7F	Upper Carson Creek drift fence	.75	Sec 16, T37N, R8W	\$2000.00
3W	Mud Spring	Tank	Sec 15, T37N, R8W	\$250
4W	Hole spring	2 Tanks	Sec 21, T37N, R8W	\$500
5W	Lower Wallace Park spring	Tank	Sec 26, T37N, R8W	\$200
31W	Lone Rock pipeline sec 1	.5 mile	Sec 22, 23 T37N, R8W	\$1414
32W	Lone Rock pipeline sec 2	1.0 mile, 3 tanks	Sec 28, 29 T37N, R8W	\$2828
33W	Davies Spring	Tank	Sec. 29, T37N, R8W	\$500
Total Value				\$28,392.00

Jack Creek C & H

Invent #	Description	Unit	Location	Value
F1	Red Creek-Lemon boundary fence	1.25 miles	Sec 15, T36N, R7W	\$3000.00
F3	Upper Jack Creek fence	.6 mile	Sec 12, T36N, R7W	\$1400.00
W1	Red Creek Spring	Tank	Sec 15, T36N, R7W	\$400.00
Total Value				\$4800.00



Vallecito C & H

Invent #	Description	Unit	Location	Value
F9	Bear trap boundary fence	.25 mile	Sec 12, T36N, R6W	\$600.00
F4	Middle mt timber sale drift fence	2.0 miles	Sec 14, 15 T37N, R6W	\$4800.00
F2	Lower Runlett Drift fence	1.25 miles	Sec 13, 14 T37N, R6W	\$3000.00
F3	Upper Runlett Drift fence	1.5 miles	Sec 11, 14 T37N, R6W	\$3600.00
F1	Vallecito Drift fence	2.0 miles	Sec 33, T37N, R6W Sec 4, T36N, R6W	\$4800.00
F7	East Creek pass Boundary fence	.25 mile	Sec 27, T37N R5W	\$600.00
F5	Tucker Lane drift fence	.75 mile	Sec 21, 28, T37N, R6W	\$1800.00
F8	Freeman Creek drift fence	1.0 mile	Sec 32, T37N, R6W, Sec 6, T36N, R6W	\$2400.00
W13	Lost Spring	Tank	Sec 31, T37N, R6W	\$200.00
W14	Decker Spring	Tank	Sec 36, T37N, R6W	\$200.00
W9	Sheep Park Spring	Tank	Sec 23, T37N, R6W	\$200.00
Total Value				\$22,200.00

Graham Creek C & H

Invent #	Description	Unit	Location	Value
1F	Graham Creek Drift fence	3.5 miles	Sec. 10, 16, 19, 20, 30 T36N, R6W	\$7200.00
2F	North Canyon drift fence	.3 mile	E1/4, sec 15, T36N, R6W	\$800.00
1W	Wilson Spring	Tank	Sec 21, T36N, R6W	\$200.00
2W	Patton Spring	Tank	Sec 19, T36N, R6W	\$200.00
3W	Dribble Spring	Tank	Sec 22, T36N, R6W	\$200.00
Total Value				\$8600.00



Lion Creek C & H

Invent #	Description	Unit	Location	Value
F1	Lion Park protection fence	1.8 miles	Sec 11, T36N, R6W	\$5400.00
F2	East Creek-Lion Creek div. Fence	.5 mile	Sec 1, 12 T36N, R6W	\$750.00
F3	Upper/lower pasture div. Fence	1.3 miles	Sec 11, T36N, R6W	\$2600.00
F4	Big Rock fence	1.0 mile	Sec 11, T36N, R6W	\$1000.00
F5	Bear trap fence	.5 mile	Sec 12, T36N, R6W	\$2000.00
W1	Bear spring	Tank	Sec 10, T36N, R6W	\$200.00
W2	Lion Spring	Tank	Sec 11, T36N, R6W	\$200.00
W3	Doe Spring	Tank	Sec 12, T36N, R6W	\$200.00
Total Value				\$12,350.00
Total allotment Values				\$100,542.00
Total miles fence lost				31.8 miles
Total lost water developments				37

Improvement Type	Units	Cost *
Wire fence	1 mi	\$7000.00
Spring development	1 ea	\$2500.00
Water system pipeline	1 mi	\$10,000.00

* All costs are approximate in that they will vary with motorized access, terrain factors and other unforeseen re-construction difficulties.



IV. FIELD OBSERVATIONS AND FINDINGS

Field reconnaissance of the burned area was conducted between July 3rd and July 7th to evaluate burn intensity, determine and document losses of vegetation and to determine range structural improvements destroyed by the fire. Range structural improvements were identified by obtaining the recorded data in the INFRA range database (location, type, value) and comparing the location to the burn severity map of the fire, provided by the Missionary Ridge Complex BAER team. The field reconnaissance verified the loss of range structures in areas that were mapped as high to moderate burn severity.

- A.** Natural barriers such as dark timber that were formerly used in conjunction with fences in the rotational grazing system have now been lost. New pasture boundaries may need to be established.
- B.** Areas where the fire was mapped as high to moderate burn severity had approximately 60-100% mortality of vegetation. These areas are high priority for reseeding, and may need to be protected from livestock grazing for up to 2 years.

V. RECOMMENDATIONS

A. Management

- 1. Evaluate which areas of the allotments may require adjustment in grazing use.
- 2. Utilize temporary fencing to restrict livestock from recovering areas to reduce resource impacts and allow vegetation recovery.
- 3. Identify fire-damaged range structures that are in critical need of replacement for desired management practices. Replace lost structures within the next 2 years for future management needs.
- 4. Utilize seed mixes that emphasize non-invasive introduced and native perennial species to provide for soil stability and potential natural community.
- 5. Remove old fence posts and wire on fences burned.

B. Monitoring

- 1. Monitor areas where there was moderate to high burn severity for vegetation recovery.
- 2. Identify areas of livestock and wildlife concentrations that could experience severe use and hamper vegetation recovery efforts, such as springs.

Jennifer Rowe, Range Conservationist, San Juan National Forest





MISSIONARY RIDGE COMPLEX

VEGETATION RESOURCE ASSESSMENT

I. OBJECTIVES

- Evaluate and assess fire impacts to vegetation resources, and identify values at risk associated with losses of vegetation cover and plant community change.
- Determine rehabilitation and monitoring needs supported by specifications to aid in vegetation recovery efforts.
- Provide management recommendations to assist in vegetation recovery, watershed stabilization, and maintenance of plant and wildlife species diversity.
- Evaluate impacts of fire to threatened, endangered, and sensitive plant species.

II. ISSUES

- Short and long-term impacts to vegetation resources on public lands within the Missionary Ridge Complex.
- Protection of vegetation resources and other resource values including site productivity, native plant communities, species diversity, wildlife habitat, and watershed stability.

III. OBSERVATIONS

A. INTRODUCTION

This assessment identifies and addresses known and potential impacts to vegetation resources within the Missionary Ridge Complex near Durango, CO that includes the Missionary Ridge West Fire, Missionary Ridge East Fire, and the Valley Fire. A total of about 70,962 acres were burned between June 9 and July 15, 2002 (projected containment). The fires occurred at the height of a record drought in Southwestern Colorado, resulting from low winter snowpack and only 1.31" of precipitation year to date of fire. Fuels were extremely dry and RH was very low, leading to unprecedented fire conditions for the area.

Findings and recommendations contained within this assessment are based on information obtained by the Resources Staff of the SJNF and BAER team specialists (many of which are members of the Resources Staff), and field reconnaissance of the burned areas.

Reconnaissance of the burned areas was conducted by helicopter and on the ground June 28-July 6, 2002. This assessment addresses the concerns and interests of the USFS, BLM, USFWS, Colorado DOW, affected leasees/permittees, and local governments, publics, and cooperators. The assessment will detail the known damage to public vegetative resources, discuss revegetation processes and expected recovery, outline management considerations to assist recovery, and identify future monitoring plans.



B. PAST AND PRESENT USE

The Missionary Ridge Fire Complex is located north and northeast of Durango, Colorado and contains predominantly USFS lands, except for the Valley Fire, which is predominantly private land. Access roads were built into the Missionary Ridge and Middle Mountain areas in the 1950's and 1960's as a part of logging activity during that period. A portion of the burned area (5904 acres) is located in the Weminuche Wilderness.

The area is generally steep and diverse, with a large variety of intermingling plant communities. Localized vegetation depends on elevation, aspect, past resource management activities, and fire history. The present principal uses and importance of the area are watershed protection, wildlife habitat, water yield, recreation, grazing, and timber harvest.

Because of its proximity to the tourist communities of Durango and Bayfield, and the resort area of Vallecito Reservoir, the area receives higher than average use by all types of recreationists. Part of the burned area is within the watershed of Lemon Reservoir, which provides municipal water for the City of Durango and irrigation water for agricultural lands. Another part of the burned area is within the watershed for Vallecito Reservoir, which supplies rural water systems and irrigation.

C. VEGETATION TYPES

Table 1: *The following major vegetation types existed within the Missionary Ridge Complex before the fire.*

VEGETATION TYPE	ACRES
Spruce-Fir	8070
Aspen	15,722
Cool-moist Mixed Conifer	19,581
Warm-dry Mixed Conifer	12,849
Ponderosa Pine	12,094
Pinyon-Juniper	201
Mountain Shrubland	2057
Mountain Grassland	1856
Riparian	144

1. Spruce- Fir Forest Type

The Spruce-Fir forest type on the San Juan National Forest (SJNF) and throughout the Missionary Ridge Complex (MRC) is dominated by Engelmann spruce and subalpine fir trees. It is associated with the subalpine climate zone, and occurs on mountain and plateau landscapes at elevations ranging from about 9000 to 11,800 feet. Mean annual precipitation ranges from 30-40 inches.

Engelmann spruce and subalpine fir trees occur together in most stands throughout this type. Douglas-fir and white fir occur in association with these species on the warmest and driest sites, usually at the lower elevations. Engelmann spruce occurs alone at the highest elevations, while aspen may be found throughout. Blue spruce and limber pine may be present, usually as minor components (< 10 % cover), the latter often found on steep slopes with southerly aspects. Lodgepole pine, a species not native to the SJNF, occurs to a minor extent in small patches within this type.

Common understory species found in the spruce-fir forest type include blueberry, common juniper, current, elderberry, honeysuckle, thimbleberry, mountain ash, maple, raspberry, buffaloberry, mountain lover, arnica, one-sided wintergreen, lousewort, strawberry, sweet cicely, violet, peavine, death camas, baneberry, sagewort, false Solomon's seal, forest fleabane, jacob's ladder, goldenweed, pipsissewa, columbine, bluebells, rattlesnake plantain, Richardson geranium, avalanche lily, fairy slipper, pussytoes, fireweed, wood nymph, wintergreen, fringed bromegrass, trisetum, ryegrass, mountain ricegrass, and elk sedge.

Fire is one of the major disturbance agents in spruce-fir forests, and influences forest conditions at the stand and landscape levels. The historic fire disturbance regime of this type during the reference period consisted of infrequent, high-severity, stand-replacement fires with median fire return intervals longer than 150-200 years (Romme et al. 1997, Romme and Knight 1981). These fire events often burned thousands of acres. Other disturbance agents associated with these forests include insect outbreaks (spruce beetle, spruce budworm), disease (*Armillaria* and other fungi), avalanches, wind events, and small fires.

2. Aspen Forest Type

The Aspen forest type on the SJNF and throughout the MRC is dominated by aspen trees. It is associated with the subalpine and montane climate zones, and occurs on mountain and plateau landscapes at elevations ranging from about 8000 to 11,200 feet. Mean annual precipitation ranges from about 22-35 inches. Most aspen forests on the SJNF and throughout the MRC are earlier seral stages of Engelmann spruce, subalpine fir, or white fir potential natural community types (DeVelice et al. 1986).

This type occurs as relatively pure stands of aspen trees comprising ³ 80% of the canopy cover, or as a mix of aspen and conifer trees where aspen makes up the largest component within a stand. Conifer trees, displayed as understory or overstory components, include Engelmann spruce and subalpine fir at higher elevations, and white fir, Douglas-fir, and blue spruce at lower elevations. Due to the variability in the composition and structure of the aspen forest type at the stand level, it is separated into conifer and aspen phases, with the former having conifer species that display a combined canopy cover ³ 20%, and the latter with conifer species absent or minor (< 20 % cover).

Common understory species found in the aspen forest type include snowberry, thimbleberry, common juniper, Woods rose, mountain lover, sweet cicely, meadowrue, arnica, brackenfern, peavine, American vetch, bluebell, violet, yarrow, false Solomon's seal, forest fleabane, columbine, bluebells, rattlesnake plantain, avalanche lily, baneberry, dandelion, Richardson geranium, Gray lousewort, osha, mountain parsley, northern bedstraw, strawberry, fringed bromegrass, ryegrass, trisetum, mountain ricegrass, Kentucky bluegrass, and elk sedge.

Fire is the major disturbance agent in aspen forests, and influences forest conditions at the stand and landscape levels. The historic fire rotation period of this type during the reference period was about 140 years (Romme et al. 1999). Fire events often burned thousands of acres. Other disturbance agents associated with these forests include insect outbreaks (spruce beetle, spruce budworm), disease (*Armillaria* and other fungi), avalanches, wind events, and small fires.



3. Cool-Moist Mixed Conifer Forest Type

The Cool-Moist Mixed Conifer forest type on the SJNF and throughout the MRC is dominated by white fir and Douglas-fir trees. It is associated with the subalpine climate zone, and occurs on mountain and plateau landscapes at elevations ranging from about 8500 to 10000 feet. Mean annual precipitation ranges from about 25-32 inches.

Douglas-fir and white fir trees are present in most stands. Engelmann spruce and subalpine fir occur on the coolest and wettest sites of this type, while aspen may be found throughout. Blue spruce and limber pine may be present, usually as minor components (< 10 % cover). Ponderosa pine and Gambel oak are absent or very minor components (< 10 % cover).

The cool-moist mixed conifer forest type occurs on cooler and wetter sites, usually at higher elevations, compared to the warm-dry mixed conifer type. This accounts in part for the more closed-canopy structure, and the more variable fire disturbance regime of this type, as compared to the warm-dry type.

Common understory species found in the cool-moist mixed conifer type include snowberry, maple, current, serviceberry, Woods rose, blueberry, thimbleberry, common juniper, elderberry, raspberry, buffaloberry, honeysuckle, mountain ash, mountain lover, violet, Richardson geranium, strawberry, forest fleabane, fairy slipper, baneberry, clematis, rattlesnake plantain, false Solomon's seal, columbine, pipsissewa, meadowrue, osha, northern bedstraw, avalanche lily, pussytoes, wood nymph, wintergreen, elk sedge, ryegrass, mountain ricegrass, and fringed bromegrass.

Fire is the major disturbance agent in cool-moist mixed conifer forests, and influences forest conditions at the stand and landscape levels. The historic fire disturbance regime of this type during the reference period was variable, consisting of both frequent, low-severity ground fires and infrequent, high-severity, stand-replacement fires with median fire return intervals ranging from about 50 to 200 years (Romme - June 2001, personal communication). Other disturbance agents associated with these forests include insect outbreaks (mountain pine beetle, spruce beetle, spruce budworm), disease (Armillaria and other fungi), dwarf mistletoe, wind events, and small fires.

4. Warm-Dry Mixed Conifer Forest Type

The Warm-Dry Mixed Conifer forest type on the SJNF and throughout the MRC is dominated by ponderosa pine, white fir and Douglas-fir trees. It is associated with the montane climate zone, and occurs on mountain and plateau landscapes at elevations ranging from about 7500 to 9000 feet. Mean annual precipitation ranges from about 20-25 inches.

White fir, Douglas-fir, and ponderosa pine trees are present in most stands, but white fir or Douglas-fir may be absent on some sites. Ponderosa pine is the key indicator species of this type, displaying a canopy cover $\geq 10\%$. Gambel oak is a significant component in these forests, occurring in most stands. Blue spruce, southwestern white pine, aspen, pinyon pine, and Rocky Mountain juniper may be present, usually as minor components (< 10% cover). Subalpine fir and Engelmann spruce are absent.

The warm-dry mixed conifer forest type occurs on warmer and drier sites, usually at lower elevations, compared to the cool-moist mixed conifer type, and often occurs on sites with

southerly aspects. The warmer, drier condition accounts in part for the more open-canopy structure, and the more frequent fire disturbance regime of this type, as compared to the cool-moist type.

Common understory species found in the warm-dry mixed conifer type include Gambel oak, snowberry, serviceberry, Oregon grape, Woods rose, kinnikinnik, geranium, peavine, strawberry, clematis, meadowrue, pussytoes, goldenrod, mountain parsley, daisy, lupine, American vetch, skyrocket, yarrow, Arizona fescue, elk sedge, bottlebrush squirreltail, junegrass, Kentucky bluegrass, and muttongrass.

Fire is the major disturbance agent in warm-dry mixed conifer forests, and influences forest conditions at the stand and landscape levels. The historic fire disturbance regime of this type during the reference period consisted of frequent, low-severity ground fires with median fire return intervals ranging from about 18 to 28 years (Romme et al. 1997). This is similar to, but slightly longer than the fire disturbance regime of the Ponderosa Pine forest type. Other disturbance agents associated with these forests include insect outbreaks (mountain pine beetle, spruce beetle, spruce budworm), disease (Armillaria and other fungi), dwarf mistletoe, wind events, and small fires.

5. Ponderosa Pine Forest Type

The Ponderosa Pine forest type on the SJNF and throughout the MRC is dominated by ponderosa pine trees. It is associated with the lower montane climate zone, and occurs on mountains, hills, and mesas at elevations ranging from about 7000 to 8500 feet. Mean annual precipitation ranges from about 16-25 inches.

This type occurs as relatively pure stands of ponderosa pine trees comprising $\geq 80\%$ of the canopy cover. Rocky Mountain juniper, white fir, Douglas-fir, southwestern white pine, blue spruce, aspen, and pinyon pine trees may be present usually as minor components ($< 10\%$ canopy cover). Gambel oak is a significant component in these forests, occurring in most stands. On the warmest and driest sites within this type, a pinyon pine phase is recognized where pinyon pine is codominant with ponderosa pine and displays a canopy cover $\geq 10\%$.

Common understory species shrubs found in the ponderosa pine forest type include Oregon grape, buckbrush, Gambel oak, bitterbrush, skunkbush, snowberry, mountain mahogany, serviceberry, mountain parsley, lupine, butterweed, pussytoes, American vetch, peavine, strawberry, cinquefoil, goldenrod, beardstongue, geranium, paintbrush, puccoon, deervetch, buckwheat, skyrocket, pasqueflower, daisy, yarrow, Kentucky bluegrass, bottlebrush squirreltail, junegrass, mountain muhly, Parry oatgrass, Arizona fescue, pine dropseed, little bluestem, muttongrass, blue grama, and elk sedge.

Fire is the major disturbance agent in ponderosa pine forests, and influences forest conditions at the stand and landscape levels. The historic fire disturbance regime of this type during the reference period consisted of frequent, low-severity ground fires with median fire return intervals ranging from about 12 to 30 years (Romme et al. 1997). Other disturbance agents associated with these forests include insect outbreaks (mountain pine beetle), disease (Armillaria and other fungi), dwarf mistletoe, wind events, and small fires.



6. Pinyon-Juniper Woodland Type

The Pinyon-Juniper woodland type on the SJNF and throughout the MRC is dominated by pinyon pine and Utah juniper trees. It occurs on mountains, hills, and mesas at elevations ranging from about 6000 to 7500 feet. It is associated with the semi-arid climate zone. Mean annual precipitation ranges from about 13-18 inches.

Pinyon pine and Utah juniper trees are present in most stands — the former usually more abundant on cooler, moister sites, the latter more abundant on warmer, drier sites within this type. Rocky mountain juniper, ponderosa pine, or Douglas-fir may be present in some stands, usually as minor components (< 10% canopy cover). Shrub cover tends to be high, with Gambel oak or big sagebrush common in many stands. Stands vary from closed-canopy with dense trees and shrubs and little herbaceous vegetation, to open-canopy with widely scattered trees and shrubs and moderate to high herbaceous cover. On the coolest and wettest sites within this type, a ponderosa pine phase is recognized where ponderosa pine is codominant with pinyon pine and displays a canopy cover ³ 10%.

A variety of shrubs are associated with this type including Gambel oak, big sagebrush, bitterbrush, buckbrush, skunkbush, mountain mahogany, serviceberry, snakeweed, Oregon grape, prickly pear, and banana yucca. Common herbs found in the Pinyon-Juniper type include butterweed, pussytoes, cinquefoil, goldenrod, sand aster, beardstongue, geranium, paintbrush, puccoon, deervetch, buckwheat, redroot buckwheat, lupine, lousewort, skyrocket, daisy, sagewort, goldeneye, yarrow, hairy goldenaster, Kentucky bluegrass, bottlebrush squirreltail, needle-and-thread, junegrass, pine dropseed, little bluestem, muttongrass, blue grama, side-oats grama, western wheatgrass, spike muhly, sand dropseed, and Indian ricegrass.

7. Mountain Shrubland Type

The Mountain Shrubland type on the SJNF and throughout the MRC is a diverse, shrub-dominated type that occurs on mountains, hills, and canyon slopes at elevations ranging from about 6000 to 9000 feet. It occurs on upland sites with well-drained soils, and is often found on steep slopes with southerly aspects. It occurs as small patches in forest-dominated landscapes, but sometimes occupies extensive areas. It is found in association with pinyon-juniper, ponderosa pine, and warm-dry mixed conifer vegetation types in the semi-arid, and lower montane, and montane climate zones. Mean annual precipitation ranges from about 14-25 inches.

This tall shrubland type occurs as relatively pure stands of Gambel oak, or as a mix of Gambel oak and other deciduous shrubs. It also includes stands dominated by mountain mahogany, serviceberry, or other shrubs where Gambel oak is absent or a minor component. Stands tend to be closed-canopy with low to moderate herbaceous cover. Other shrubs associated with this type include bitterbrush*, Woods rose, chokecherry, big sagebrush, fenderbush, snowberry, skunkbrush, squawapple, Oregon grape, and prickly pear.

Pinyon pine, Utah juniper, Rocky mountain juniper, ponderosa pine, or Douglas-fir trees may be present in the mountain shrubland type, usually occurring as scattered individuals. Common herbs associated with this type include goldenrod, locoweed, milkvetch, lupine, geranium, yarrow, dandelion, meadowrue, American vetch, mulesears, daisy, trailing fleabane, cinquefoil, muttongrass, junegrass, blue grama, bottlebrush squirreltail, needle and thread, Indian ricegrass, Kentucky bluegrass, elk sedge, and mountain muhly.

8. Mountain Grassland Type

The Mountain Grassland type on the SJNF and throughout the MRC occurs as openings in forest-dominated landscapes. It occurs on upland sites with well-drained soils in mountain and plateau landscapes. It is associated with the lower montane, montane, and subalpine climate zones at elevations ranging from about 7500 to 11,600 feet.

Within the general mountain grassland type, there are three more specific grassland types on the SJNF. The Arizona fescue type occurs at elevations from about 7500 to 9000 feet, and is primarily associated with ponderosa pine and warm-dry mixed-conifer forests. The Thurber fescue type occurs at higher elevations from about 8500 to 11600 feet, and is primarily associated with spruce-fir and cool-moist mixed-conifer forests. The Kentucky bluegrass type occurs at elevations from about 7500 to 11600 feet, and is associated with ponderosa pine, both mixed-conifer, and spruce-fir forests.

The Arizona and Thurber fescue types are tall, bunchgrass communities dominated by Arizona fescue and Thurber fescue respectively. Forbs, sod-forming grasses, and sedges occupy the spaces between bunchgrasses. Sites in good ecological condition, display high canopy-cover of Arizona and Thurber fescue, abundant litter, minimal bare soil, and soils with thick surface horizons. Sites where ecological conditions are not as good display lower canopy-cover of Arizona and Thurber fescue, less litter, more bare soil, and more Kentucky bluegrass, noxious weeds, dandelion, annual species, and native increaser species including yarrow, strawberry, cinquefoil, sneezeweed, trailing fleabane, pussytoes, and mulesears.

Common species of the Arizona fescue type include Arizona fescue, mountain muhly, Parry oatgrass, junegrass, little bluestem, bottlebrush squirreltail, mountain brome, blue grama, needle-and-thread, needlegrass, pine dropseed, muttongrass, elk sedge, Kentucky bluegrass, American vetch, daisy, trailing fleabane, yarrow, dandelion, mulesears, lupine, fringed sage, cinquefoil, buckwheat, peavine, geranium, and goldenrod. Common species of the Thurber fescue type include Thurber fescue, Arizona fescue, timber oatgrass, junegrass, mountain brome, needlegrass, wild rye, sedge, Kentucky bluegrass, cinquefoil, American vetch, trailing fleabane, daisy, yarrow, sneezeweed, dandelion, harebell, meadowrue, and geranium. Shrubs, including big sagebrush and black sagebrush for the Arizona fescue type, and shrubby cinquefoil and snowberry for the Thurber fescue type, may be present as minor components.

The Kentucky bluegrass type is a short, sod-forming type dominated by Kentucky bluegrass and the native increaser species mentioned above. Noxious weeds, dandelion, and annual species are common. Arizona and Thurber fescue are absent or minor components. This type commonly displays high amounts of bare soil, minimal litter, and soil erosion and compaction problems. These grasslands are a zootic disclimax type (Daubenmire 1966) due to sustained livestock grazing since the reference period that has significantly changed their composition and structure, from that of an Arizona or Thurber fescue bunchgrass type during the reference period, to the current bluegrass type (Fleischner 1994, Wuerthner 1992, Belsky et al. 1997, Turner 1976).

D. VEGETATION STRUCTURAL CONDITIONS (PRE-BURN)

Wildlife Structural Stages (WSS) are used here to describe structural conditions at the stand level for forest and shrubland vegetation types within the Missionary Ridge Complex. They serve as a general surrogate for seral stages.

**Table 2:** Wildlife structural stages.

Structural Stage Code	Structural Stage	Description
1	Grass-Forb	Herbaceous vegetation, very early-seral
2	Shrub-Seedling	Trees < 5 inch DBH, early-seral
3a	Sapling-Pole	Trees 5-9 inch DBH, Canopy cover of 25-39%, early-seral
3b	Sapling-Pole	Trees 5-9 inch DBH, Canopy cover of 40-69%, early to mid-seral
3c	Sapling-Pole	Trees 5-9 inch DBH, Canopy cover of 70-100%, mid-seral
4a	Mature	Trees > 9 inch DBH, Canopy cover of 25-39%, mid-seral
4b	Mature	Trees > 9 inch DBH, Canopy cover of 40-69%, mid to late-seral
4c	Mature	Trees > 9 inch DBH, Canopy cover of 70-100%, mid to late-seral

Table 3: Wildlife structural stages by vegetation type in acres (pre-burn).

Vegetation	Stage 2	3a	3b	3c	4a	4b	4c
Spruce-Fir	92	39	402	241	415	5167	1713
Aspen			1541	525	345	9714	3597
Cool-moist Mixed Conifer		23	446	784	986	11271	6072
Warm-dry Mixed Conifer			652	256	107	8800	3035
Ponderosa Pine			308		2495	8869	424
Pinyon-Juniper			96		46	60	
Mountain Shrubland	2057						

E. THREATENED, ENDANGERED, AND SENSITIVE PLANT RESOURCES

Review of the San Juan National Forest and Colorado Natural Heritage Program databases revealed that there are no known Threatened, Endangered, or Forest Service Sensitive plant species that occur within the Missionary Ridge Complex.

IV. FIELD OBSERVATIONS AND FINDINGS

A. METHODS

On July 1, 2002, a multidisciplinary BAER team assembled in Durango, CO to begin rehabilitation assessments. A Landsat image of the burned area was obtained on July 2, 2002 to derive a burn intensity map to use as a tool for ground observations.

Field reconnaissance of the burned area was conducted between June 28 and July 6, 2002 to evaluate the effects of burn intensity, determine and document losses of vegetation, and identify impacts to other related resource values. Locations were selected to inspect each of six vegetation



types (spruce-fir, aspen, cool-moist mixed conifer, warm-dry mixed conifer, ponderosa pine, and mountain shrubland) at four fire intensity levels (none, low, moderate, and high), giving a total of 24 combinations. At each location we observed and recorded vegetation type, burn severity, burn intensity, percent ground cover, percent surface rock, occurrence of mass instability, recovery potential, and rehabilitation needs. We also took a photo and recorded GPS coordinates for each location to facilitate future monitoring. Additionally we collected a composite soil sample at each location to test for the presence of a viable seed bank. This was evaluated using a simple germination test of three sub-samples for each location.

GIS maps of burn intensity and pre-fire vegetation were overlaid to identify areas where post-fire vegetation recovery may be impaired and special rehabilitation efforts may be needed.

B. VEGETATION IMPACTS

The fire burned in a mosaic pattern with burn intensities of high, moderate, low, and unburned. Overall, 31% of the MRC burned at high intensity, 30% at moderate intensity, 19% at low intensity, and 20% was unburned. Large patches of all burn intensities occur within the MRC. High burn intensity sites for all the vegetation types killed about 75-100% (mostly 90-100%) of all above-ground trees, shrubs, forbs, and graminoids, and burned 90-100% of the litter layer. These sites experienced stand-replacement fire, which set them back in their successional pathway to an early-seral stage.

Low burn intensity sites experienced relatively low tree mortality (10-25% for the conifer vegetation types and 30-50% for the aspen type). The degree to which shrubs, herbaceous vegetation, and litter was killed or impacted on low intensity sites for all the vegetation types is highly variable. On low burn intensity sites, the Gambel oak-dominated mountain shrublands experienced above-ground oak mortality in the 30-50% range. Low burn intensity sites experienced changes in species composition and structure, but not significant enough to change their successional status.

Moderate burn intensity sites are highly variable. They experienced tree mortality of about 25-75% for the conifer vegetation types and 50-75% for the aspen type. The degree to which shrubs, herbaceous vegetation, and litter was killed or impacted on moderate intensity sites for all the vegetation types is highly variable. On moderate burn intensity sites, the Gambel oak-dominated mountain shrublands experienced above-ground oak mortality in the 50-75% range. Moderate burn intensity sites experienced changes in species composition and structure, enough to change their successional status in some cases. Tree mortality for all sites affected by the fire is expected to continue for the next few years.

Fire impacts to mountain grasslands and riparian areas was not significant. Bunchgrasses such as Thurber fescue and Arizona fescue appear to have survived the fire even in the high intensity sites, as their crowns were intact and new leaf growth was already appearing.

Throughout the fire area, even on sites that burned at high intensity, very fine and fine roots of trees, shrubs, forbs, and graminoids appeared to be intact (not burned) in the upper inch of mineral soil. It is hypothesized that this is an indication that seeds in the mineral soil survived the fire and are available to germinate, grow, and establish cover on burn sites. Rhizomes of grass species also appear to have survived the fire and are expected to regenerate readily after fire.

**Table 4:** Acres burned by vegetation type and burn intensity class.

VEGETATION TYPE	HIGH INTENSITY	MODERATE INTENSITY	LOW INTENSITY	UNBURNED	CLOUD COVER
Spruce-Fir	1036	1027	3108	2757	142
Aspen	2719	3165	3928	5760	151
Cool-moist Mixed Conifer	4665	4122	6928	3713	154
Warm-dry Mixed Conifer	4474	3438	3849	1035	52
Ponderosa Pine	3839	4029	3444	778	4
Pinyon-Juniper	76	102	23	0	0
Mountain Shrubland	582	1253	366	97	16
Mountain Grassland	87	501	756	494	19
Riparian	0	20	72	52	0

Due to extremely dry conditions, the fire burned through higher elevation aspen and spruce-fir ecosystems that do not readily burn in normal years. Because of the severe drought and extreme dryness leading up to the fires, the vegetation was already under high stress at the time of the fire. The trees and other vegetation was in the shoot elongation stage at the time of the fire, making it more vulnerable to injury because 1) the young tissue is more easily killed than mature tissue, and 2) on conifers there is a lack of buds to provide later re-growth. Additionally, we found evidence of light and moderate hydrophobicity in areas with moderate and high burn intensity. This water-repellency can interfere with water infiltration for soil-borne seeds to germinate and for the roots of surviving plants to obtain moisture.

C. VEGETATION STRUCTURAL CONDITIONS (POST-BURN)

High intensity burn sites in most forested stands will become shrub-dominated stands (WSS 2) in the short-term after the fire. Ponderosa Pine, Warm-dry Mixed Conifer, and Mountain Shrubland vegetation types will become Gambel oak-dominated shrublands, and Spruce-Fir, Cool-moist Mixed Conifer, and Aspen types will become aspen-dominated shrublands. Trees killed by the fire will be significant structural components in high intensity burn sites, both as snags (standing dead trees) and large woody material on the ground.

Moderate intensity burn sites in forest and shrubland stands will change by a reduction in their canopy cover. 4C stands will change to 4a or 4b, due to the openings created by tree mortality associated with the fire. Similarly, 3C stands will change to 3a or 3b. Trees killed by the fire may be significant structural components in moderate intensity burn sites, both as snags (standing dead trees) and large woody material on the ground. An increase in Gambel oak and aspen may occur due to sprouting stimulated by the above-ground mortality of those species.

Low intensity burn sites in forest and shrubland stands may change by a reduction in their canopy cover, but it will be relatively minor, and probably not enough to change WSS.

Table 3: Wildlife structural stages by vegetation type in acrea (post-burn).

VEGETATION	Stage 2	3a	3b	3c	4a	4b	4c
Spruce-Fir	85	39	307	163	1415	3892	1133
Aspen	7985		818	212	3393	6113	2466
Cool-moist Mixed Conifer		10	268	297	4629	6196	3516
Warm-dry Mixed Conifer			184	77	3494	3722	898
Ponderosa Pine			207		4965	2852	232
Pinyon-Juniper			96		46	60	
Mountain Shrubland	10371						

D. VEGETATION RECOVERY

Gambel Oak and aspen are species that regenerate from root suckers following disturbance such as fire. Since these species are common and abundant on many sites throughout the MRC (see vegetation descriptions), it is expected that they will readily sprout and provide cover. During our field observations, we already observed a significant amount of oak and aspen sprouting in areas that had burned just two weeks before. This included areas with high burn intensity, and was occurring in spite of the severe drought. Overall, we expect adequate natural vegetation recovery in areas where either oak or aspen were present before the fire. It appears that the oak and aspen will provide some cover by late summer and fall provided the anticipated summer rains occur, but significant cover of these species likely won't occur until next summer. Other species observed sprouting and recovering from the fire include snowberry, Wood's rose, chokecherry, lupine, American vetch, elk sedge, brackenfern, Thurber fescue, dandelion, and thistle.

The major conifer species of the MRC (ponderosa pine, Douglas-fir, white fir, subalpine Fir, Engelmann spruce, pinyon pine, Utah juniper, and Rocky Mountain Juniper) are more limited in their response to fire. Unlike many deciduous trees and shrubs (aspen, oak), the root systems of conifers do not regenerate from root suckers. In order for a conifer to survive the fire, some of the roots, the cambium of the main trunk, and the buds must survive. Since the conifers were in the shoot elongation phase of their spring growth at the time of the fire, there are no buds available to survive and provide future re-growth. Given this situation, the best predictor of survival for the conifers will be the amount of scorched foliage on the trees. In general, if at least one-third of the foliage is still green, and the cambium is alive, the tree has a chance of surviving. The greater the amount of green foliage, the better the prognosis.

The seeds of many shrubs and forbs can persist in the soil for years. A fire can open an area to greater sunlight and warmth, which stimulates the germination of some seeds. Hard seeds with thick seed coats are ruptured by fire, allowing the seed to absorb water and germinate. Raspberry, gooseberry, and chokecherry seed are stimulated in this way. Many grass species are rhizomatous and regenerate readily after fire. Bunchgrasses have crowns beneath the soil surface that are insulated from the effects of fire.

The simple germination test to determine the amount of viable seed in soil samples collected from six vegetation sites and four burn intensities yielded inconclusive results. After 11 days, there was little seed germination, and the number of seedlings was similar in all burn intensities. There was some

germination at all burn intensities for all of the vegetation types, but it was too low and inconsistent to draw conclusions. The limited results from this test indicate that some viable seed is present post-burn in soil from all of the vegetation types and burn intensities, but we cannot say how much seed is present nor can we speculate on what the natural seed germination response will be post-burn based on this test.

Overall, considering the ecological mechanisms of plant survival discussed above, we feel that natural vegetation recovery will proceed at adequate levels over most of the burned area, provided there is adequate moisture for regrowth during the next few years. Because of severe plant stress due to the drought, we expect fire-year regrowth to be only an amount needed for plant survival. However, in the year following the fire, assuming better moisture conditions, we expect a much stronger response.

The concern regarding regrowth following the fire is on areas where high burn intensity fire occurred in large patches of dense conifers on steep slopes. On these sites, most of the vegetation is dead and the litter is mostly gone. Oak and aspen are expected to resprout on these sites if they were present before the fire. If these species were not present before the fire, woody vegetation may be slow to re-establish. Other shrubs, forbs, and graminoids are also expected to recover on these sites, but the rate and amount are dependent on survival of existing plants and/or seeding from adjacent stands. In the short-term (next 2-3 years), there is a concern for erosion and runoff from these areas since the vegetation cover may be sparse.

Several species of mushrooms (e.g., morels) are stimulated by wildfires, and mushroom hunters seem to know this. The implication is that there may be increased use of the area by individual and commercial mushroom hunters.

V. RECOMMENDATIONS

A. MANAGEMENT

1. Seed areas where high burn intensity occurred in large patches on steep slopes, as these sites are devoid of protective vegetation cover and are highly susceptible to erosion and runoff. These areas should be aerially seeded with a grass mixture that includes an annual cover crop and appropriate native perennial species. Recommended seed mix includes annual ryegrass, spring wheatgrass (annual), mountain brome grass, slender wheatgrass, and western wheatgrass.
2. Areas where moderate and low burn intensity occurred generally have adequate protective vegetation cover and currently are not highly susceptible to erosion and runoff. No treatments are recommended for these areas.
3. Should post-fire conditions favor mushroom hunting, post appropriate information on the SJNF website to warn mushroom hunters of the hazards of falling snags and stump holes, and to post permit information and other guidance.

B. MONITORING

1. The sampling locations used for vegetation recovery assessments should be re-visited in subsequent years and monitored for rate, quantity, and quality of regrowth. New sites should also be selected and monitored for these attributes.

2. Areas where aerial seeding occurs should be monitored for rate, quantity, and quality of regrowth, and overall effectiveness of seeding treatment.

V. CONSULTATIONS

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VI. REFERENCES

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MISSIONARY RIDGE FIRE COMPLEX

FISH AND WILDLIFE RESOURCE ASSESSMENT

I. OBJECTIVES

- Assess the effects of fire and current suppression actions to Federally listed Threatened, Endangered, Proposed, and Federal Candidate species and their habitats.
- Assess the effects of proposed emergency rehabilitation actions to Federally listed Threatened, Endangered, Proposed, and Federal Candidate species and their habitats.
- Conduct Section 7 Emergency Consultation with the U.S. Fish and Wildlife Service (FWS).
- Assess the effects of fire and current suppression actions on Forest Service (FS) Region 2 and State BLM Sensitive species with habitat on the San Juan National Forest (SJNF) and San Juan BLM Resource Area, and other species of concern.
- Assess the effects of fire and suppression actions to habitat improvements.
- Prescribe emergency rehabilitation measures and/or monitoring.

II. ISSUES

- Two Federally listed T&E species occur within, adjacent to, or downstream of the fire area. Habitat for one Federal Candidate is also present within and adjacent to the fire area. What are the potential impacts to these species from the fire itself, suppression actions, and rehabilitation actions?
- 23 combined FS and BLM Sensitive species have habitat within, adjacent to, or downstream of the fire area. What are the potential impacts to these species from the fire itself, suppression actions, and rehabilitation actions?
- 11 other species of concern occur within, adjacent to, or downstream of the fire area. What are the potential impacts to these species from the fire and subsequent activities?

III. OBSERVATIONS

The purpose of this Burned Area Emergency Rehabilitation (BAER) Fish and Wildlife Assessment is to document the effects of the fire, suppression activities, and rehabilitation work to all Federally listed Threatened, Endangered, Proposed, and Federal Candidate species and their habitats. The assessment also discusses fire effects and the effects of suppression actions to FS and BLM sensitive species and their habitats, and other species of concern and their habitats as identified by FS, BLM, and Colorado Division of Wildlife (CDOW) biologists. This assessment includes effects to species that occur on lands under the jurisdiction of the SJNF, San Juan BLM Resource Area (SJRA), and Colorado State Forest Service.

This assessment also presents information that is included in documentation of Section 7 Emergency Consultation for this incident. Emergency consultation will be initiated with the FWS as required by the Endangered Species Act. Detailed consultation documentation is on file at the San Juan Public Lands Office and the Columbine Ranger District Field Office.

Species occurrence information discussed in this assessment is based on formal surveys for species and habitat inventories conducted prior to the incident, and during fire reconnaissance. Documents, inventory data, sighting records, vegetation maps and other species-specific information referenced in this report are on file at the offices mentioned above.

A. BACKGROUND

This assessment identifies and addresses known and potential impacts to fish and wildlife resources within the Missionary Ridge Fire Complex near Durango, CO that includes the Missionary Ridge Fire and the Valley Fire. 72962 acres burned between June 9 and July 13, 2002 (projected containment). The fires occurred at the height of a record drought in Southwestern Colorado, resulting from low winter snowpack and only 1.31" of precipitation year to date of fire. Fuels were extremely dry, relative humidity very low, and temperature and wind speeds moderately high, leading to unprecedented fire conditions for the area.

The Missionary Ridge Fire Complex is located northeast of Durango, Colorado and contains predominantly FS lands, except for the Valley Fire, which is predominantly private land. Access roads were built into the Missionary Ridge and Middle Mountain areas in the 1950's and 1960's as a part of logging activity during that period. A portion of the burned area (approximately 5904 acres) is located in the Weminuche Wilderness.

The area is generally steep and diverse, with a large variety of intermingling plant communities. Localized vegetation depends on elevation, aspect, past resource extraction activities, and fire history. The principal uses and importance of the area are watershed protection, wildlife habitat, water yield, recreation, grazing, and limited timber production.

Because of its proximity to the tourist communities of Durango and Bayfield, and the resort area of Vallecito Reservoir, the area receives higher than average recreation use. Part of the burned area is within the watershed of Lemon Reservoir, which provides municipal water for the City of Durango and irrigation for agricultural lands. Another part of the burned area is within the watershed for Vallecito Reservoir, which supplies rural water systems and irrigation.

B. RECONNAISSANCE METHODS AND RESULTS

Information used in this assessment is based on a review of relevant literature, SJNF, SJRA and CDOW species sighting and habitat inventory data, consultation with FWS, personal communication with agency biologists, and field reconnaissance of the burned area. Reconnaissance included ground review of the fire area from June 24-28, July 1 and July 6.

Burn severity and intensity were mapped by the BAER team to determine effects on watershed, soils, and vegetation resources. Habitat quantity and quality for species addressed in this assessment were determined from mapped data collected during the incident and existing FS and BLM vegetation GIS databases. Species distribution and abundance were determined using FS, BLM, and CDOW population databases.

To better understand the species habitat information briefly discussed in this assessment, it is important to review the Missionary Ridge Fire Complex BAER Vegetation and Watershed Resource Assessments. These reports contain detailed descriptions of pre-fire vegetation conditions, post-fire effects to watersheds and vegetation, and post-fire vegetation recovery estimates. Effects of the fires on vegetation in terms of fish and wildlife habitat are the primary focus of this assessment. A description of how wildlife habitat is identified is given in the Vegetation Resource Assessment.

This assessment is not intended to definitively answer the many questions of fire effects on specific species. The focus of this assessment is to identify the need for immediate, emergency actions that may be necessary to prevent further effects on Federally listed species, and FS and State BLM Sensitive species. Some of the species discussed in this assessment have ranges or territories that extend beyond the burned area, crossing a variety of land ownerships or jurisdictions. Therefore, it is necessary to include relevant off-fire information in the discussions.

C. FINDINGS

Tables 1, 2 and 3 list species that were considered for this assessment.

Table 1. Federally listed species for the SJNF and SJRA based on May 2, 2001 list from the FWS, and confirmed on July 10, 2002. Parentheses indicate State listing status by the CDOW.

SPECIES GROUP	STATUS
Mammals: Black-footed ferret Canada lynx	Endangered (Endangered) Threatened (Endangered)
Birds: Bald eagle Gunnison sage grouse Mexican spotted owl Southwestern willow flycatcher Yellow-billed cuckoo	Threatened (Threatened) Candidate (CDOW Special Concern Species) Threatened (Threatened) Endangered (Endangered) Candidate
Fish: Bonytail Colorado pikeminnow Humpback chub Razorback sucker	Endangered (Endangered) Endangered (Threatened) Endangered (Threatened) Endangered (Endangered)
Insects: Uncompahgre fritillary butterfly	Endangered
Amphibians: Boreal toad	Candidate (Endangered)
Plants: Knowlton's cactus Mancos mill-vetch Mesa Verde cactus Sleeping Ute milk-vetch	Endangered Endangered Threatened Candidate



Table 2. Forest Service Region 2 sensitive fish and wildlife species based on March 21, 1994 list for the SJNF, and State BLM sensitive fish and wildlife species based on March 17, 2000 list for the SJRA.

SPECIES GROUP	STATUS	HABITAT WITHIN, ADJACENT TO, OR DOWNSTREAM OF FIRE AREA
Amphibians:		
Boreal toad	FS Sensitive	Yes
Northern leopard frog	FS and BLM Sensitive	Yes
Tiger salamander	FS Sensitive	Yes
Birds:		
American bittern	FS Sensitive	No
Black swift	FS Sensitive	No
Black tern	BLM Sensitive	No
Boreal owl	FS Sensitive	Yes
Columbian sharp-tailed grouse	FS and BLM Sensitive	No
Common loon	FS Sensitive	Yes
Ferruginous hawk	FS and BLM Sensitive	Yes
Flammulated owl	FS Sensitive	Yes
Fox sparrow	FS Sensitive	Yes
Golden-crowned kinglet	FS Sensitive	Yes
Greater sandhill crane	FS Sensitive	No
Gunnison sage grouse	BLM Sensitive	No
Lewis' woodpecker	FS Sensitive	Yes
Loggerhead shrike	FS Sensitive	No
Long-billed curlew	FS and BLM Sensitive	No
Merlin	FS Sensitive	Yes
Northern goshawk	FS and BLM Sensitive	Yes
Olive-sided flycatcher	FS Sensitive	Yes
Osprey	FS Sensitive	Yes
Purple martin	FS Sensitive	No
Pygmy nuthatch	FS Sensitive	Yes
Three-toed woodpecker	FS Sensitive	Yes
Western burrowing owl	FS Sensitive	No
White-faced Ibis	FS and BLM Sensitive	No
Fish:		
Colorado River cutthroat trout	FS and BLM Sensitive	No
Mammals:		
Allen's big-eared bat	BLM Sensitive	No
American marten	FS Sensitive	Yes
Big free-tailed bat	BLM Sensitive	No
Canada lynx	FS Sensitive	Yes
Dwarf shrew	FS Sensitive	Yes
Fringed myotis	BLM Sensitive	Yes
North American wolverine	FS Sensitive	No
Ringtail	FS Sensitive	Yes
Spotted bat	FS and BLM Sensitive	No
Townsend's big-eared bat	FS and BLM Sensitive	Yes
Yuma myotis	BLM Sensitive	No
Reptiles:		
Milk snake	FS and BLM Sensitive	Yes
Desert spiny lizard	BLM Sensitive	No
Texas horned lizard	BLM Sensitive	No

**Table 3. Other species of concern**

SPECIES GROUP	STATUS
Mammals:	
Black bear	CDOW Big Game Species
Elk	CDOW Big Game Species
Mule deer	CDOW Big Game Species
River otter	CDOW Endangered Species
Birds:	
American peregrine falcon	CDOW Special Concern Species
Merriam's turkey	CDOW Game Bird Species
Fish:	
Brook trout	CDOW Sport Fish
Brown trout	CDOW Sport Fish
Cutthroat trout (various species mix)	CDOW Sport Fish
Kokanee salmon	CDOW Sport Fish
Rainbow trout	CDOW Sport Fish

1. Fire Effects on Federally Listed Threatened, Endangered, Proposed, and Federal Candidate Species and Their Habitats

Based on the above species lists, the bald eagle and Canada lynx are the only two Federally listed wildlife species with habitat affected by the Missionary Ridge Fire. Neither species was affected by the Valley Fire. Currently, there are no boreal toad populations within the fire area, on the Forest, or surrounding BLM lands, and therefore, no significant concerns have been identified as a result of the fire (personal communications, Mike Japhet, CDOW Aquatic Biologist).

No threatened, endangered, or candidate fish species occur within the burn area. Two listed species, the Colorado pikeminnow and razorback sucker, occur downstream in New Mexico. For these species, there is the need to initiate emergency consultation procedures with the U.S. Fish and Wildlife Service for water depletions resulting from fire suppression efforts (pers. com., Al Phister, USFWS, 7/8/02). However, this should have no bearing on emergency rehabilitation efforts and will be dealt with separate from this assessment.

Direct effects as described in this report refer to mortality or disturbance that results in flushing, displacement, or harassment to the species. Indirect effects refer to modification of habitat and/or effects to prey species.

a. Bald Eagle

Bald eagles are primarily fall migrants to the SJNF and surrounding BLM lands. They are observed around Lemon and Vallecito Reservoirs during these periods catching various trout species, and kokanee salmon especially during early winter salmon spawning runs. Additionally, they are commonly observed in the lower reaches of the Florida and Los Pinos Rivers perched in large cottonwood and ponderosa pine trees along river corridors where they capture fish, and consume deer and elk carrion in lower elevation big game winter ranges.



Adult bald eagles have been observed around Lemon Reservoir and may be nesting in the vicinity of Young's Canyon northwest of the reservoir (personal communications, Scott Wait, CDOW Terrestrial Biologist). To date, there have been no nests detected in the area, but it is very likely that a breeding territory exists, and that the pair remains in the area for most of the year, moving to lower elevations during winter when the reservoir and Florida River ice over. It is expected that no winter roosting habitat is available near Lemon or Vallecito reservoirs due to the lack of abundant food sources to attract and hold wintering eagles.

Fire direct effects: It is very likely bald eagles in the vicinity of Lemon Reservoir were temporarily displaced by smoke and flames, especially during the extremely erratic fire behavior that occurred at the onset of the fire. Additionally, if any eagles were present within the vicinity of Lemon or Vallecito Reservoirs and air space used by numerous helicopters and air tankers, they may have experienced displacement caused by increased noise and activity.

Fire indirect effects: Fire intensity within Young's Canyon was generally low to moderate, and in many cases there were unburned forested stands. Fire intensity outside the canyon along ridge tops and upper mesas was varied, resulting in some forested stands receiving very intense fire behavior (total consumption of ground fuels, and understory and overstory vegetation), to stands receiving moderate to low fire behavior (more surface fire activity with occasional flare-ups which created holes in the overstory). Effects to potential nesting habitat include the loss of potential perch trees, and other large trees that could provide other nesting opportunities. However, the fire has also created some additional perch trees by opening up the canopy and creating sound snags with open branches that usually provide good perch tree structure.

Fire suppression effects: Potential direct effects to bald eagles may have included temporary displacement caused by increased noise and activity from helicopters and air tankers working in the area. Suppression actions on the ground (hand crews working the fire and increased vehicular traffic) may have had some effect, but these effects are difficult to measure. Indirect suppression effects to bald eagle habitat include the removal of snags and other potential perch trees that pose a threat to fire fighter and public safety. Given the large amount of snags and potential future fire-created snags present within the burn area, suppression actions have likely had insignificant effects on perch trees. These effects will be assessed in more detail when the fire is declared controlled and more information is available.

Emergency rehabilitation effects: Measures recommended in the BAER Plan will have beneficial effects on bald eagles because they include actions to prevent soil loss, help protect water quality and fisheries, and revegetate portions of the fire area. They are intended to minimize potential adverse cumulative watershed effects.

b. Canada Lynx

During 1999 and 2000, the CDOW transplanted a total of 96 lynx into the San Juan Mountains on both the Rio Grande and San Juan National Forests. The CDOW has been monitoring these animals since then, and have reported observations of individuals in the fire area prior to the burn. No individuals have been reported within the fire area since the fire started (personal communications, Scott Wait, CDOW Terrestrial Biologist). Recent monitoring of the animals shows individuals adjacent to the fire several miles away in the Weminuche Wilderness Area, Hermosa Area, and near Silverton.

The SJNF in cooperation with the BLM, FWS, and CDOW has mapped denning, winter foraging, other habitat, and currently unsuitable habitat across the Forest. Additionally, the BLM has draft maps of lynx habitat across the BLM Resource Area. In conjunction with mapping habitat, lynx analysis units (LAU's) have been identified and are used as the primary analysis units for assessing impacts to lynx habitat conditions. Currently, the fire has effected habitat within the Animas, Bear Creek, Upper Florida River, Upper Los Pinos River, and Vallecito Creek LAU's. A more complete description of the criteria used to map lynx habitat on the SJNF is on file at the San Juan Public Lands Center and Columbine Ranger District/Field Office.

Fire direct effects: There are no anticipated direct effects to individual lynx as a result of the Missionary Ridge Fire. As mentioned earlier, there have been no reports of lynx within the fire area since the fire started.

Fire Indirect effects: Table 4 describes total lynx habitat before the fire and amount of habitat currently available based on the current fire perimeter. The remaining tables display the same information, but broken out by LAU. The amount of habitat displayed accounts for changes in habitat conditions as a result of high, moderate, and low burn intensities. For example, high intensity fires in lynx habitat were modeled to show that they no longer provide habitat because forested areas no longer provide habitat components suitable for denning (large amounts of downed logs), winter foraging (dense regenerating conifers providing habitat for snowshoe hare), or other uses such as travel (overhead cover). Moderate intensity fires in lynx habitat were also modeled to show they no longer provide habitat because like high intensity fires, they affect habitat components suitable for denning, winter foraging, or other uses such as travel. Based on field reconnaissance, small patches of unburned habitat remain within these moderate intensity fire areas and forest floor structure (downed logs, etc.), and understory vegetation were unaffected, but habitat quality for prey species has still likely been reduced. The amount of lynx habitat affected within each LAU will be assessed in more detail when the fire is declared controlled.

Table 4: Total Lynx Habitat Before the Fire and Habitat Available Based on Current Fire Perimeter

HABITAT TYPE	AMOUNT OF HABITAT PRE-FIRE	AMOUNT OF HABITAT BASED ON CURRENT FIRE PERIMETER	CURRENT RESULTS INDICATE A DIFFERENCE OF
Denning habitat	17769	11687	-6082
Winter foraging habitat	13149	7203	-5946
Other habitat	12975	7059	-5916
Currently unsuitable habitat	1283	17702	+16419

Animas LAU

HABITAT TYPE	AMOUNT OF HABITAT PRE-FIRE	AMOUNT OF HABITAT BASED ON CURRENT FIRE PERIMETER	CURRENT RESULTS INDICATE A DIFFERENCE OF
Denning habitat	4164	1907	-2257
Winter foraging habitat	3454	1164	-2290
Other habitat	4501	1598	-2903
Currently unsuitable habitat	535	7478	+6943



Bear Creek LAU

HABITAT TYPE	AMOUNT OF HABITAT PRE-FIRE	AMOUNT OF HABITAT BASED ON CURRENT FIRE PERIMETER	CURRENT RESULTS INDICATE A DIFFERENCE OF
Denning habitat	8875	5818	-3057
Winter foraging habitat	6801	3805	-2996
Other habitat	6217	3704	-2513
Currently unsuitable habitat	428	8319	+7891

Upper Florida River LAU

HABITAT TYPE	AMOUNT OF HABITAT PRE-FIRE	AMOUNT OF HABITAT BASED ON CURRENT FIRE PERIMETER	CURRENT RESULTS INDICATE A DIFFERENCE OF
Denning habitat	2172	1933	-239
Winter foraging habitat	1047	905	-142
Other habitat	553	502	-51
Currently unsuitable habitat	158	538	+380

Upper Los Pinos River LAU

HABITAT TYPE	AMOUNT OF HABITAT PRE-FIRE	AMOUNT OF HABITAT BASED ON CURRENT FIRE PERIMETER	CURRENT RESULTS INDICATE A DIFFERENCE OF
Denning habitat	1252	1054	-198
Winter foraging habitat	664	511	-153
Other habitat	778	462	-316
Currently unsuitable habitat	19	645	+626

Vallecito Creek LAU

HABITAT TYPE	AMOUNT OF HABITAT PRE-FIRE	AMOUNT OF HABITAT BASED ON CURRENT FIRE PERIMETER	CURRENT RESULTS INDICATE A DIFFERENCE OF
Denning habitat	1117	788	-329
Winter foraging habitat	1148	788	-360
Other habitat	865	734	-131
Currently unsuitable habitat	0	572	+572

Fire suppression effects: Currently, there are no anticipated direct effects to lynx because there have been no lynx reported in the fire area. Of the current approximate 103 miles of dozer line, and 14 miles of handline, roughly 60% is estimated to occur in lynx habitat. These areas are being rehabilitated to minimize soil erosion, other watershed concerns, and potential illegal motorized use in sensitive areas. These effects will be assessed in more detail when the fire is declared controlled.

Rehabilitation effects: Rehabilitation measures should have beneficial effects on lynx because they include actions to prevent soil loss, help protect water quality, and revegetate portions of the fire area. These actions will cumulatively provide benefits to prey species such as snowshoe hares by minimizing soil erosion and other impacts to habitat.

2. Fire Effects on Forest Service Region 2 and State BLM Sensitive Species

No significant concerns were identified by FS, BLM, or CDOW biologists for sensitive species listed in Table 5, because: 1) no habitat is present for them, 2) very limited habitat is available, 3) the fires had minimal direct and/or indirect impacts to habitat, or 4) they have been reported to rarely occupy habitat within the fire areas, habitat adjacent to the fire areas, or habitat downstream of the fire areas. These determinations were based on knowledge of local habitats and species occurrences, and cursory reviews of habitat associations and species distributions in the State of Colorado from current literature by Andrews and Righter (1992), Fitzgerald et al. (1994), and Hammerson (1999).

Table 5: Sensitive species not affected by the fire

AMPHIBIANS	BIRDS	FISH	MAMMALS	REPTILES
Boreal toad	American bittern	Colorado River cutthroat trout	Allen's big-eared bat	Milk snake
Northern leopard frog	Black swift		Big free-tailed bat	Desert spiny lizard
Tiger salamander	Black tern		Ringtail North American wolverine	Texas horned lizard
	Columbian sharp-tailed grouse		Spotted bat	
	Common loon		Yuma myotis	
	Ferruginous hawk			
	Fox sparrow			
	Greater sandhill crane			
	Gunnison sage grouse			
	Logger head shrike			
	Long-billed curlew			
	Merlin			
	Purple martin			
	Western burrowing owl			
	White-faced ibis			

Table 6 shows FS and State BLM sensitive species that were directly and indirectly affected by the fires. Also included are estimated acreages of potential habitat prior to the burns and post-burn potential habitat.

Fire direct effects: The direct effect on these species likely included temporary displacement, and possibly mortality, given the erratic fire behavior over much of the fire area at the onset of the fire.

Fire indirect effects: Habitat quality and quantity has been reduced in many areas and is tied heavily to fire intensity. High intensity burned areas show the greatest impact on habitat attributes (forest cover, snags, downed logs, etc.) used by these species. Areas of moderate to low intensity show less impact on habitat attributes. Many species will benefit from fire as a result of increased habitat. Olive-sided flycatchers will benefit from snags and increased edge that provide ideal habitat for perching and foraging. Three-toed and Lewis' woodpeckers will find abundant food sources such as beetles moving into to the affected areas.

Fire suppression effects: Increased human presence and various techniques used to suppress the fires likely caused temporary displacement of some species, and impacts to habitat due to ground disturbance. Fire suppression and emergency rehabilitation measures will improve habitat conditions by reducing potential adverse cumulative watershed effects.

Table 6: Sensitive species affected by the fire

SPECIES	PRE-BURN POTENTIAL HABITAT	CURRENT POTENTIAL HABITAT
American marten	27651	21950
Boreal owl	8070	7034
Dwarf shrew	Difficult to assess as little is known about the ecology and behavior of the species. The specie also uses a variety of different habitats.	Difficult to assess as little is known about the ecology and behavior of the specie. The specie uses a variety of different habitats.
Flammulated owl	60246	52532
Fringed myotis	12295	8456
Golden-crowned kinglet	8070	7034
Lewis' woodpecker	12094	8255+
Northern goshawk	60246	52532
Olive-sided flycatcher	60246	60246+
Osprey	Three known nests around Vallecito Reservoir	One nest unaffected by fire, unsure of another, and last nest affected by fire but managed to remain standing
Pygmy nuthatch	12094	8255
Three-toed woodpecker	27561	21950
Townsend's big-eared bat	12295	8456

Current observations: Olive-sided flycatchers, three-toed woodpeckers, and ospreys have been observed in the fire areas.

3. Fire Effects on Other Species of Concern

a. Fish

Several high-value fishery resources can be affected by suppression and post-suppression activities. The likelihood of large-scale debris, mud, and ash flows that alter physical habitat and water chemistry is a major risk to some fisheries (see potential debris flow map). Altered water chemistry resulting from fire retardant applications may also occur. Long-term incremental soil and bank erosion and increased sediment loading is also a concern. The construction of fire lines, especially bulldozer lines, provide an additional source of sediment and can act as hydrologic conduits to stream channels.

Not including affected downstream channels outside of the burn perimeter, there are approximately 687 miles of stream channel within the burn. There are 84 miles of perennial stream, 207 miles of "primary" intermittent channels, and 242 miles of "secondary" intermittent channels (identified through contour crenulations). Of the 84 miles of perennial stream, approximately 50 miles are known to support fish populations. Table 7 lists streams within the burn area that support self-sustaining fisheries. Total fish biomass per stream mile provides an estimate of stream productivity. High value/risk areas that should be considered for emergency rehabilitation include those areas of high productivity associated with high levels of burn intensity (see burn intensity map in Appendix III).

Table 7: Fish-bearing streams within or immediately adjacent to the burned area

STREAM NAME	STREAM ORDER	STREAM MILES	SPECIE OCCURRENCE	TOTAL BIOMASS (lbs/ac)
D Creek	3	6.5	Brook Trout	4
East Creek	3	6.7	Brook Trout, Brown Trout Rainbow Trout	46
Florida River (above Lemon Reservoir)	4	6.6	Kokanee Salmon Rainbow Trout Brown Trout, Brook Trout	46
Grimes Creek	3	6.6	Kokanee Salmon Rainbow Trout Brook Trout	NA
Los Piños (above Vallecito Reservoir)	5	4.0	Kokanee Salmon Rainbow Trout Cutthroat Trout Brown Trout, Brook Trout	40
Los Piños (below Vallecito Reservoir)	5	4.7	Brown Trout Rainbow Trout Mottled Sculpin	60
Red Creek (Florida Drainage)	3	4.3	Rainbow Trout	NA
Shaerer Creek	3	3.1	Rainbow Trout Brook Trout, Brown Trout	110
North, East, & West Fork Shearer	2, 1, 2	0.86, 0.85, 3.5	Brook Trout	NA
Vallecito Creek	5	5.6	Kokanee Salmon Brown Trout, Brook Trout Rainbow Trout, Cutthroat Trout, Mottled Sculpin	NA



Of special concern are Grimes Creek, Vallecito Creek, and the Los Piños River. Grimes Creek is one of the few streams in Colorado where natural reproduction of kokanee salmon has been documented. The CDOW places high priority on maintaining this population. Also, Vallecito Creek represents a primary egg source for hatchery-reared kokanee. It produces approximately 20 percent of the kokanee eggs that are brought into the State's hatchery system each year. Spawn-taking facilities are located at the mouth of Vallecito Creek, just upstream from Vallecito Reservoir. The CDOW has emphasized the need to control debris flows to that location.

In the Los Piños immediately downstream of Vallecito Reservoir, the Coolwater Ranch has made investments in stream improvements for the purpose of enhancing fish populations. The Ranch generates some income from recreational fishing activities. Although not officially designated, this fishery is considered equivalent to a Gold Medal stream (pers. com., Mike Japhet, CDOW, 7/5/02). Based on fire intensity analysis, this section of river appears to be at high risk of fishery losses. Tributary drainages effecting this reach include Red Rock Canyon, Browns Canyon, Red Creek, Dry Creek, and Jack Creek.

b. Black Bear, Elk, Merriam's Turkey, and Mule Deer

These species are all common species that inhabit the burned areas during most of the year. Black bears are year-round residents and use all habitats present in the burned areas. Deer and elk use all habitats present in the burned areas, and are very common during spring, summer, fall, and even early winter depending on snow depths. Merriam's turkey's are very common in the burned areas, and can be found using all habitats, but they are most commonly found at lower elevations.

Fire direct effects: Depending on the mobility of the animal, most of these species can avoid the fire by fleeing. There have been reports of some elk mortality.

Fire indirect effects: Table 8 describes the pre-burn and post-burn amounts of habitat present for other species of concern. Hoover and Wills (1984) describe a way to rate the value of forage and cover by analyzing structural stage values for each cover type. Forage estimates for pre-burn and post-burn are the same for some species such as black bear. Forage quality will likely increase because of the lush regeneration that will result, improving not only herbaceous food sources, but also food sources for prey species.

Other generalist species such as elk, mule deer, and turkey will also gain forage habitat as a result of the lush new growth occurring over the next 1-10 years, depending on the habitat type. Cover has been reduced for elk and deer because of the loss of overstory and understory vegetation consumed by the fire. Cover for turkey will increase because of the amount of regeneration reaching the shrub stage primarily in aspen and Gambel oak over the next 1-5 years.

Fire suppression effects: The building of handline, dozer line, safety zones, and helispots has likely caused some temporary displacement of animals in the immediate areas. Rehabilitation efforts will help minimize potential adverse cumulative watershed effects in these areas, and to reduce the number of corridors suitable for illegal off-road use by motorized vehicles.

Current observations: All species have been reported in the fire areas.

Table 8. Pre-burn and post-burn forage and cover (acres) for other species of concern based on habitat analysis described by Hoover and Wills (1984)

SPECIES COVER	PRE-BURN	CURRENT BURN FORAGE	PRE-BURN FORAGE	CURRENT BURN COVER
Black bear	70518	70081	66219	50475
Elk	29602	49442	64117	37090
Mule deer	60354	66562	66519	55602
Merriam's turkey	31557	45311	30125	43251

c. River Otter

River otters have been reported along the Los Pinos River extending from the New Mexico – Colorado State line into the Weminuche Wilderness Area (personal communications, Scott Wait, CDOW Terrestrial Biologist). Additionally, according to CDOW records, there are limited sightings in the Animas Drainage, and to date, there have been no confirmed reports above County Road 234 and the Florida River, but they likely occur within the upper portions of the drainage (personal communications, Scott Wait, CDOW Terrestrial Biologist).

Fire direct and indirect effects: Potential effects to river otter will depend greatly future effects to the areas watersheds. Some of the concerns include the effects to structures such as beaver dams (used to mark territories) from erosion, and the potential impacts to the areas fisheries also from erosion.

Current fire suppression effects: There are no anticipated direct effects from suppression activities such as the use of helicopters, air tankers, and machinery (dozers and vehicles) because of the very limited amount of activity near river corridors.

d. Peregrine Falcon

There are two peregrine falcon eyries within or near the fires. The East Animas eyrie above the Animas River is not occupied this year. The Vallecito eyrie is occupied and located at the east end of the fire where suppression activities are still underway.

Fire direct effects: There are likely no direct effects to either peregrine falcon eyrie. The East Animas eyrie was well protected from fire given its location on the vertical cliff face. The Vallecito eyrie is still outside the fire perimeter and also high on a cliff face.

Fire indirect effects: Potential indirect effects will depend heavily on the effects to prey species (various bird species) habitat as a result of the fire. Avian response to the fire will depend heavily on the habitats affected and the burn intensity. Early successional adapted species will likely increase, while species associated with mature or late successional (closed canopy and older stands) forest habitats may be more affected in areas exposed to high burn intensities. Avian response in forested areas with low to moderate burn intensities will also display similar shifts, but not to the degree as high intensity burn areas.

Fire suppression effects: There are no anticipated direct effects from suppression activities to the East Animas eyrie. Falcons occupying the Vallecito eyrie have likely experienced some disturbance from air operations.



Suppression and emergency rehabilitation measures will benefit the species by minimizing potential adverse cumulative effects to watersheds.

3. Fire Effects on Wildlife Habitat Improvements Within the Burned Area

Wildlife habitat improvements within the Missionary Ridge Complex burned area include the seven wildlife guzzlers listed below. Current reports indicate that all but the Stevens Creek #2 guzzler were affected.

- ☐ Coon Creek guzzler
- ☐ Elk Horn Canyon guzzler
- ☐ Haflin Canyon guzzler
- ☐ Red Creek #1
- ☐ Red Creek #2
- ☐ Stevens Creek #1
- ☐ Stevens Creek #2

IV. PROPOSED EMERGENCY REHABILITATION TREATMENTS

- ☐ Aerial seeding on approximately 15,000 acres
- ☐ Log erosion barriers on approximately 7300 acres
- ☐ Straw mulch on approximately 300 acres
- ☐ Straw matting on approximately 80 acres
- ☐ Precipitation and early flow warning systems
- ☐ Engineering design of stream diversion at Lemon Dam spillway
- ☐ Engineering assessment and design to stabilize slumps in drainages
- ☐ Debris jam monitoring after rainfall events
- ☐ Treatment effectiveness monitoring
- ☐ Numerous road and trail specifications, including culvert replacement, culvert installation, grade dip construction, ditch cleaning, sign replacement, and trail assessment and repair
- ☐ Hazard tree removal along roads, trails, campgrounds, and near some private land boundaries

V. RECOMMENDATIONS

A. Emergency stabilization: No treatments recommended

B. Emergency rehabilitation: No treatments recommended

C. Management recommendations that are beyond the scope of BAER

1. Section 7 Emergency Consultation for fire suppression actions will need to be completed when the fire is declared controlled and more information on suppression activities exists.
2. A survey of the Young's Canyon area should be done to document any potential nesting of bald eagles and to assess fire effects in more detail.
3. Continue close coordination with the CDOW in monitoring any potential use of the burned areas by Canada lynx

4. Continue close coordination with the CDOW in monitoring the East Animas and Vallecito peregrine falcon eyries.
5. Continue close coordination with the CDOW in monitoring the three osprey nests on Vallecito Reservoir.
6. The fire improved habitat for a number of woodpeckers, including Lewis' woodpecker, three-toed woodpecker, hairy woodpecker, downy woodpecker, and northern flicker. Subsequent management proposals in the burned area should include a careful analysis to consider minimizing any actions that might reduce beneficial fire effects.
7. Snag retention during post-fire salvage operations should follow the policy and guidelines developed for the Forest Plan, or modified based on the latest scientific information.
8. Risks to fishery resources stem from unstable watershed conditions that ultimately degrade in-channel habitat quality. Watershed treatments designed to enhance groundcover and stabilize soil and stream banks will be beneficial to fisheries. Options for treatment include seeding, mulching, contour felling, water bars, and a variety of stream bank reinforcements (see Soil and Watershed Assessment, Appendix A.). The fisheries information above should be used to help prioritize watershed remediation efforts.

VI. FIRE EFFECTS DETERMINATIONS

A. Suppression Action and Proposed Emergency Rehabilitation Action Effects to Habitats Federally Listed Threatened, Endangered, Proposed, and Federal Candidate Species and Their

The effects of fire suppression activities have yet to be determined because the fire has not yet been declared controlled at the time of this assessment, and there are still suppression activities occurring.

1. Bald Eagle

Suppression action effects: To be determined

Proposed emergency rehabilitation action effects: Proposed rehabilitation treatments will provide long-term benefits to bald eagles by reducing potential adverse cumulative watershed effects to Lemon and Vallecito Reservoirs and affected drainages. There may be some potential for minor disturbance to bald eagles in the area as a result of noise and human presence, but these effects should be insignificant.

Determination: The proposed rehabilitation treatments may effect, but are not likely to adversely effect, bald eagles or their habitat.



2. Canada Lynx

Suppression action effects: To be determined

Proposed emergency rehabilitation action effects: Proposed rehabilitation treatments will provide long-term benefits to lynx by reducing potential adverse cumulative watershed effects. These activities will likely indirectly benefit prey species by improving habitat, or minimize impacts to habitat caused by erosion. There may be some potential for minor disturbance to lynx should they move into the area as a result of noise and human presence, but these effects should be insignificant.

Determination: The proposed rehabilitation treatments may effect, but are not likely to adversely effect, Canada lynx or lynx habitat.

3. Boreal Toad

Proposed emergency rehabilitation action effects: Proposed rehabilitation treatments will provide long-term benefits to boreal toads and toad habitat by reducing potential adverse cumulative watershed effects.

Determination: The proposed rehabilitation treatments will have beneficial effects on the boreal toad and toad habitat.



VI. CONSULTATIONS

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MISSIONARY RIDGE COMPLEX

TIMBER RESOURCE ASSESSMENT

I. OBJECTIVES

- Identify and evaluate fire related impacts to commercial forest timber both in and outside of the suitable timber base.
- Identify direct/indirect effects on forest health.
- Address needed treatments for forest resources

II. ISSUES

- Tree mortality and potential salvage of commercial forest products.
- Regeneration of commercial tree species within severely burned areas.
- Potential insect response within and adjacent to burned areas.

III. OBSERVATIONS

This report addresses known and potential impacts to forest resources as a result of the Missionary Ridge Complex near Durango, Colorado. The Missionary Ridge Complex consists of two fires, the Missionary Ridge Fire and the Valley Fire.

Findings and recommendations contained within this assessment are based on information obtained by the Silviculturist for the Headwaters Timber Zone and BAER team specialists (many of who are employees of the San Juan National Forest).

Field reconnaissance of the burned area was conducted between June 15 and July 6, 2002, to determine fire effects on various stand conditions and to validate a Landsat-derived burn intensity map (obtained July 2, 2002).

A. BACKGROUND

The Missionary Ridge Fire began on June 9, 2002 from an apparent man-caused start adjacent to the Missionary Ridge Road. Long-term drought conditions, extremely low RH's and fuel moistures, winds, plume-dominated fire behavior, and continuous dense fuels contributed to very rapid fire spread and extreme burning conditions. The fire burned through Gambel oak, ponderosa pine, mixed conifer, aspen, and spruce-fir cover types. Fire acreage is approximately 72,962 acres.

This fire burned mostly on National Forest System (NFS) lands, though some Bureau of Land Management, Bureau of Reclamation, Colorado State, and private lands were also burned. Numerous structures were destroyed by this fire.

The Valley fire began on June 25, 2002. This fire totaled 439 acres and also destroyed numerous structures. It burned in ponderosa pine.

See the Vegetation Resource Assessment for a detailed discussion of the vegetation types in which the fire burned.

Large portions of the burned area have received some form of silvicultural treatment in the past. Much of the lower elevation ponderosa pine stands, much of which is private property, was heavily cut near the turn of the 20th century. Approximately 10,963 acres of the fire occurred on National Forest System lands approved as suitable for wood fiber production in the San Juan National Forest Land and Resources Management Plan. Much of this suitable base acreage has received past harvest and reforestation treatments. These include clearcutting of spruce-fir and aspen forests, planting of lodgepole pine and Engelmann spruce in many of the spruce-fir clearcuts, and intermediate cutting in spruce-fir and mixed conifer stands. Numerous acres of lands outside the present suitable base have also received similar silvicultural treatments, including prescribed burning many acres of Gambel oak stands to improve forage and browse for big game.

There are no current or planned timber sales within the burn area.

The fires burned through numerous vegetation types. Table 1 categorizes the total acreage within the fire perimeter by vegetation types and by jurisdiction.

Table 1: Vegetation types and acreage by ownership within the burned area

Vegetation Type	Acres				
	NFS	BLM	State	Private	Total
Spruce-fir	8,069			1	8,070
Aspen	14,840	48	24	811	15,722
Cool-Moist Mixed Conifer	18,357	237	70	917	19,581
Warm-Dry Mixed Conifer	10,382	36	54	2379	12,849
Ponderosa pine	7,321	370	107	4296	12,094
Pinyon-Juniper	186			15	201
Mt. Shrubland	2048			337	2057
Mt. Grassland	1648			209	1856
Riparian	50	2		92	144
Other	35			25	60
Total	62,936	691	255	9,082	72,964

B. TREE DAMAGE AND MORTALITY

A detailed survey of post-fire stand conditions in the burned area has not been completed. Lacking that data, fire intensity was estimated for this assessment. The assessment team made the estimations by applying the following definitions to Landsat images depicting burn intensities:

1. High intensity burn — stand replacement fire, all trees of all species are dead.
2. Moderate intensity burn — significant torching of dominant and co-dominant trees, very heavy mortality of understory trees, much underburning of ladder fuels and dead/down material. Post-fire stand retains it's pre-burn size class but at significantly reduced densities.
3. Low intensity burn — occasional torching of dominant/co-dominant trees, light to moderate underburning of ladder fuels and dead/down material. No significant overstory structural or density changes.

4. Unburned. Very little scorching of overstory trees, burn confined to ground with light to moderate burning of dead/down material. Not easily discernable to satellite imagery.

Table 2. Timber mortality rates by burn intensity and cover type

Burn Intensity	Cover type	% Mortality
High	All	100
Moderate	Spruce-fir	50
	Cool Moist Mixed Conifer	50
	Warm Dry Mixed Conifer	50
	Ponderosa Pine	40
	Aspen	75
Low	All conifers except PP	20
	PP	10
	Aspen	40
Unburned	All	insignificant

The assessment team estimated tree mortality based on visual observations of stands burned at the various fire intensity levels, plus an assumption that an additional percentage of currently surviving trees will later succumb to fire damage.

Timber volume affected by the fire was calculated using pre-fire stand data and the above estimated mortality factors. The figures in Table 3 include all burned areas regardless of ownership, suitability, access, operability, or other constraints. In practice, the amount of timber considered for harvest or salvage would undoubtedly be lower.

Table 3 displays the estimated volume of pre-fire standing wood greater than 9" in diameter and the estimated volume of wood killed by the fire.

Table 3. Estimated pre-burn and post-burn merchantable wood volume (volumes in gross thousands of cubic feet)

Cover Type	Pre-fire Green Volume >9" DBH	Post-fire Mortality Volume >9" DBH
Spruce-fir	29,262	10,126
Aspen	38,022	16,116
Cool/Moist Mixed Conifer	52,564	25,493
Warm/Dry Mixed Conifer	23,603	17,061
Ponderosa Pine	18,435	11,022
Total	161,886	79,818



C. PONTENTIAL SALVAGE AND RECOVERY OF TIMBER VALUE

Decisions regarding potential salvage and recovery of killed or damaged timber on NFS/BLM lands will require intensive field reconnaissance and will be made through an interdisciplinary NEPA process. While many areas of potential salvage are currently accessible by existing roads and treatable with conventional ground-based logging systems, other areas would require considerations and analysis for new access and/or use of cable or helicopter logging technologies. There may be opportunities for cooperative endeavors with adjacent private land owners.

D. REFORESTATION

Decisions regarding reforestation of burned over lands will also require intensive field reconnaissance and analysis through the NEPA process.

It is reasonable to expect some natural regeneration to occur, particularly where aspen is a component of the stand. Aspen is abundant in many areas of the burn, occurring both as relatively pure stands and as minor to significant components of many spruce-fir and mixed conifer stands. In these situations, significant aspen regeneration can be expected in areas of high and moderate burn intensity, resulting in nearly pure stands of aspen, or as mixed stands of new aspen sprouts with a scattered clumpy overstory of surviving conifers. Where burn intensities where low (or very light in areas classed as unburned), aspen regeneration is likely to occur in the openings created by the torching of clumps of conifers. Long-term survival of this regeneration is more problematic, depending in large part upon the amount of shade from the surviving conifers that is cast upon the openings.

Natural regeneration of conifers is much more questionable, especially in the short-term. Successful regeneration of conifers is dependent upon a good seed crop falling upon a satisfactory seedbed while having favorable weather with the right combination of warmth and precipitation to sustain the new germinates for several years until they become established seedlings. Severely burned sites may lack enough suitable seed trees to provide abundant seed, while lightly burned sites may not have a suitable seed bed. A major factor on all sites will be competition from newly emerging grasses, forbs, and shrubs. In the ponderosa pine and warm/dry mixed conifer sites, Gambel oak is a very rapid and prolific sprouter. While it does provide needed protection to the burned over watersheds, it also rapidly occupies seedbeds and is a strong competitor for moisture and sunlight needed for pine and Douglas-fir seedlings.

Successful re-establishment of desirable conifers in severely burned watershed or on lands desired for production of conifer timber will most likely require expensive artificial reforestation. Preferred species would be ponderosa pine, Douglas-fir, and Engelmann spruce. Seed collection will be necessary to either establish the initial seed bank (Douglas-fir) or to supplement or replace existing seed inventories.

Several cover type situations offer the greatest challenge to reforestation. Spruce-fir stands without aspen present may well return to a grass-forb stage for many decades before conifer tree seedlings become re-established. Ponderosa pine and warm/dry mixed conifer stands both contain significant amounts of Gambel oak in their understories. The oak will sprout profusely following fire and can quickly occupy the site, making regeneration of ponderosa pine and Douglas-fir very difficult. Where these conditions exist within the suitable timber base, future management of the wood-fiber resource will be severely compromised. Table 4 displays the acres with high risk of cover type conversion both within and outside of the current suitable timber base. These sites should be a high priority for evaluation for reforestation treatments.

Table 4. Acres at High Risk for Cover Type Conversion.

Cover Type	Acres		Total
	Suitable	Non-suitable	
Spruce-fir	265	170	435
Warm/dry MC	461	4013	4474
Ponderosa pine	765	3074	3839
Total	1491	7257	8748

E. FOREST HEALTH

Stands that experienced low mortality and some that experienced moderate mortality will likely benefit from the thinning effect of the fire. The vigor of surviving undamaged trees will increase due to reduced competition and accelerated nutrient cycling. Small openings created by fire will provide favorable conditions for establishment of new seedlings, possibly increasing or maintaining structural diversity, while at the same time re-establishing potential ladder fuels.

The risk for a population build-up of bark beetles and other forest insects may occur in areas where a mosaic burn and under-burn took place. Scorching of needles and partial bole girdling may further weaken trees stressed by several years of drought, making them attractive to a number of forest insects.

The pine engraver beetle (*Ips pini*) is a potential short-term (i.e. 1-2 year) threat to ponderosa pine. The western pine beetle (*Dendroctonus brevicornis*) and red turpentine beetle (*Dendroctonus valens*) also are potential pests, though probably more localized.

The mountain pine beetle (*Dendroctonus ponderosae*) is a longer term (1-4 years) threat. It may build populations in killed or damaged pine trees, developing new broods that attack other damaged trees or spreading to adjacent green undamaged trees. Within the mixed conifer forests, fire-damaged Douglas-fir trees are known to be susceptible to attack by the Douglas-fir beetle, *Dendroctonus pseudotsugae* as well as the fir engraver (*Scolytus ventralis*). White fir and subalpine fir are also host to the fir engraver.

The Engelmann spruce bark beetle (*Dendroctonus rufipennis*) generally has a two-year life cycle and, like the mountain pine beetle, can develop large epidemic populations given the right conditions. Blown-down timber, however, is more conducive to building epidemic populations of these two insects than is fire-killed timber.

Fortunately, endemic populations of all bark beetles are currently low, with perhaps a slight upward trend. There have been sporadic outbreaks of the Douglas-fir bark beetle in localized areas. Also in the past several years, we have seen a slight upward trend (from a very low initial level) in mountain pine beetle attacks in ponderosa pine

Wood boring insects are another potential for concern in regard to salvage and recovery of dead or damaged timber. While not a cause of mortality, wood borers construct extensive galleries in the interior wood of tree boles, often introducing or spreading normal decay fungi and physically weakening the wood, resulting in less value for structural grade lumber.



F. FUELS

Fire behavior, spread rates, and burn intensity associated with the Missionary Ridge Complex were the result of a complex interaction of factors. Extremely dry fuels and dense forests with high ladder fuels combined with topography and unstable atmospheric conditions to allow a ground fire to quickly turn into a plume-dominated inferno.

Fuel moistures taken at various locations across the San Juan National Forest were among the lowest ever recorded. Ten-hour and 1000-hr fuel moistures were 3-5%. Daily ERC calculations were nearly all above the 90th percentile, often matching or exceeding existing maximums. Ignition potentials were above 90%. Another unusual factor was the extremely low relative humidity (often single digits) and the lack of night-time RH recovery; nightly RH recoveries often were only in the teens or low 20's, even on occasion remaining in the single digits far into the night. Interestingly, a brief review of live fuel moisture records taken at scattered lower elevation locations across SW Colorado since 1994 suggests that, in spite of the drought, live fuel moistures for ponderosa pine were not unusual for this time of year.

Fuel loadings and stand densities appear to be other significant contributing factors. Abnormally dense ponderosa pine stands with heavy Gambel oak understories and mixed conifer stands with high proportions of white fir in both the over- and understories appear to have contributed greatly to fire spread and intensity.

Fire control operations did not make significant progress until fire behavior and spread moderated with cooler and more humid weather. Only then did containment efforts began to exceed fire growth. The only areas that showed resistance to fire spread were aspen stands or mixed conifer stands with a significant component of aspen and some high elevation spruce-fir stands — when wind was not a contributing factor.

In areas of high intensity fire, there is very little fuel left, except for some dead and down “heavies”. Over time the large amount of standing dead trees will fall, increasing the heavy fuel-loading as grasses, forbs, brush and small trees re-establish. Fuel loadings from this jackstrawed downfall could approach 40-60 tons per acre. These fuels will not contribute greatly to fire spread, but during dry years will burn readily and will make control of fires difficult.

In areas of moderate intensity burn much of the understory vegetation (i.e. Gambel oak and white fir) has been burned, greatly reducing the density and continuity of this ladder fuel layer. In the short term this will contribute to decreased risk of crown fire development. The creation of holes in the overstory by the mixed severity fire breaks up the continuity of the canopy layer, also helping to reduce the risk of crown fire sustaining itself. Long-term, in the absence of future fuel treatment needs, the fall of standing dead trees will add more heavy fuels in the understory and the Gambel oak and white fir ladder fuels will return.

Areas of low intensity burn in pine and mixed conifer stands may see only slight changes in their fuel loading conditions. Because of the dry 1000-hr fuel condition, many of the heavy fuels may have burned out, however much of the ladder fuels remain, and regrowth will occur rapidly. These stands will need to be considered for future fuel treatments within 10-15 years to maintain any beneficial effect from this fire.

Future fire suppression operations may need to be evaluated for containment objectives. Firefighter safety needs to be weighed against acceptable burn area when working in high-density snag areas, especially in difficult terrain with limited access.



III. RECOMMENDATIONS

There were no recommendations identified that could be considered emergency fire rehabilitation concerning the timber resources damaged or destroyed by the Missionary Ridge Complex. The following recommendations should be considered as long-term rehabilitation and recovery. However, because of the complexities and long time frames involved in planning and completing these recommended activities, initial evaluations should begin as soon as possible. As part of this necessary planning process, examine the Forest Plan for issues requiring potential interpretations, amendments, or revisions.

A. TIMBER RECOVERY

1. Begin initial field reconnaissance and evaluation of opportunities for recovery of dead or damaged merchantable timber, including a market analysis for disposal of any offered material.
2. Examine opportunities for cooperative ventures with adjacent agencies and private landowners.
3. Initiate consultation with the Regional Logging Engineer to examine most efficient logging systems and with the Regional Silviculturist for assistance and coordination with the National Fire Plan.
4. Initiate search for field and technical assistance in Gate 1 recon and design.
5. Acquire needed skill and expertise in "blitz" or rapid assessment for preparing/completing any necessary NEPA document in a timely manner.
6. Coordinate with Forest Engineering staff and LaPlata county to perform necessary pre-emptive road maintenance or reconstruction to facilitate the continued integrity of the transportation system in light on the high threat of fire related erosion and flooding.

B. REFORESTATION

1. Begin initial field reconnaissance and evaluation of needs or desires for reforestation of burned lands.
2. Review and evaluate the status of available seed and begin preparations as needed for collection of needed seed to establish an initial seedbank or provide for replacement seed.

C. INSECTS

1. Request a baseline Biological Assessment from the Gunnison Service Center for monitoring and evaluation of post-burn mortality and insect activity.
2. Establish cooperative monitoring programs with adjacent landowners to extend this monitoring to private lands.

D. FUELS

1. Coordinate with National Fire Plan programs to evaluate needs for follow-up fuels treatments on private and adjacent public lands.
2. Engage in continuing public education and awareness programs stressing the need for long term and repetitive actions to maintain fire safe environments.



IV. CONSULTATIONS

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MISSIONARY RIDGE COMPLEX

ROADS AND TRAILS ASSESSMENT

I. OBJECTIVES

- Assess fire impacts on roads and trails.
- Evaluate impacts of potential runoff on roads and trails, drainage structures and down slope areas.
- Determine rehabilitations needs to repair roads and drainage structures.
- Identify and address any public safety issues related to future road use.

II. ISSUES

- Changes in the expected runoff from the burn areas will have short and long term impacts on roads given the nature and location of future rain and snow events and the rate of vegetation recovery.
- Potential threat to public and employee safety due to hazards along the traveled way.

III. OBSERVATIONS

A. BACKGROUND

There are approximately 123 miles of National Forest System roads within the perimeter of the fire and an estimated 65 miles of "non-system roads" or other roads that had been closed or otherwise considered unnecessary for the management and use of the National Forest. Many of the non-system roads have been reopened during fire suppression efforts as fire breaks (dozer lines) and for equipment access. The scope of this report is roads that are not rehabilitated under fire suppression efforts. This includes all maintenance level 2,3,4 and 5 roads which had been open to public travel prior to the burn, all level 1 roads which had been previously gated or closed to motorized travel, and those non-system roads that need to be recontoured or otherwise stabilized to prevent further degradation of the watershed. An estimated 19 miles of system roads are within moderate and high severity burn areas.

There are approximately 52 miles of National Forest System trails within the perimeter of the fire and an estimated 10 miles of "non-system trail. An estimated 20.3 miles of system trails are within moderate and high severity burn areas.

B. RECONNAISSANCE METHODS AND RESULTS

Roads within the fire perimeter were physically inventoried to determine existing or potential emergencies. Treatments were identified and costs developed. All work was done in collaboration and with input from the BAER team. Trail emergency and treatment costs were based upon estimated emergency repair needs projected from current documented inventories within the high and moderate severity areas.



C. FINDINGS

1. Roads and trails are at risk due to the severely impacted areas adjacent to the road or trail, which results in increased runoff and soil movement onto and through the road or trail drainage.
 - a. Existing drainage structures on the roads or trails are not designed to accommodate the expected storm runoffs without severely damaging the road or trail and adjacent down slope resources.
 - b. Additional drainage structures and special design features such as overflow grade dips and armoring are required to carry the expected runoff from roads and additional water bars and lead out ditches are needed on trails.
 - c. Ditches and culverts need to be cleaned as soon as possible and kept cleaned to accommodate runoff.
2. Safety signing has been lost in some areas and additional signing is needed due to unsafe conditions caused by the burn. Signs marking trails have been burned.
3. Many hazard trees exist along the roads and trails.
4. Numerous travel routes have been re-opened as a result of burned out vegetation that previously blocked the road, or as a result of fire suppression activities. Many of these roads are upslope from the main access and as a result may concentrate runoff onto the main road.
5. The existing trail tread requires stabilization to repair burned out stump holes and tread prism loss.

D. RECOMMENDATIONS

1. Drainage structures must be replaced or added to handle the increased runoff.
 - a. *Culvert Replacement in Perennial Streams.* Replace undersized culverts in all perennial streams. Culverts will be sized based upon a 5-year post-burn runoff estimate, and replacement will be done in accordance with FS specification for Roads and Bridges. Five (5) major culverts will be needed across perennial streams.
 - b. *Culvert Replacement and New Culvert Installation in Ephemeral or Intermittent Drainages.* Replace undersized culverts and install additional culverts with appropriate features such as grade dips and armoring to handle increased flows either through or over the structure. An estimated 61 culverts will need to be added or replaced.
 - c. *Install Grade Dips.* This treatment will decrease the threat from flood damage on roads and delivery of sediment to down slopes and streams by draining water from road surfaces in moderate and high severity burn areas. Grade dips are installed just downgrade of road/stream crossing structures to insure the overtopping stream flow is directed back into its natural channel. The grade dips will be designed to drain water off of the road, but still allow motorized vehicle crossing. The dips are typically skewed 30 degrees and the outlets will be

- armored with riprap in most areas, particularly those in close proximity to the streams or on a vulnerable fill slope. An estimated 95 dips are needed on Level 1 through 4 roads.
- d. *Culvert and Ditch Cleaning.* Clean all ditches and drainage structures to improve the existing structure's ability to handle storm runoff. Particular attention must be paid to the 19 miles within the moderate and high burn severity areas. Cleaning must occur at a greater frequency than for unburned areas.
 - e. *Correcting Fire Damage to Trails.* Install additional drainage structures on trails such as drain dips and lead out ditches. These treatments will be used to reduce the threat in increased flow originating on the burned slopes above the traveled way running down onto the road or trail and causing rilling and excess sedimentation in the stream channels. These treatments will disperse the flow of water over the fill-slope to more stable areas. An estimated 5 miles of tread stabilization and construction of 1100 water bars will be required.
2. Signing needs to be replaced or installed to provide warning and direction to users in the burned areas.
 - a. *Warning Signs.* Warning sign must be installed to warn potential users and employees of hazards.
 - b. *Trail Sign Replacement.* Trail signs identifying the locations of the trail must be replaced.
 - c. *Road Sign Replacement.* Traffic warning signs must be replaced.
 3. Hazard trees must be treated along all trails within the wilderness and outside the wilderness and along open roads within the burned areas. This treatment reduces the chance for damage to life or property by reducing the risk of trees falling on employees or the public. Nineteen (19) miles of road and 20 miles of trail require hazard tree treatment.
 4. Recontour Roads. Roads that are not on the transportation system are typically very poorly constructed and have a high likelihood of contributing to erosion and sedimentation due to insufficient drainage. This treatment will restore slope hydrology and facilitate the storage of water on the slopes, thus helping to eliminate the overall water yield and threat of flooding. This treatment also helps decrease the threat of soil erosion and sediment delivery to streams by reducing the chance of road fill failure onto slopes or streams. An estimated 10 miles of unclassified or non-system roads should be assessed to determine if they should be recontoured.
 5. Trail safety assessment needs to be completed as soon as it is safe to complete.



IV. CONSULTATION

Facility	Name	Phone Number
Roads	Paul Christensen	970-385-1269
	Bill Ivy	970-882-6844
	Bob Sieger	970-385-1275
	Ray Ollila	605-341-3081
Trails	Miles Newby	970-259-8453
	Richard Speegle	970-375-3310
	Paul Peck	970-385-1209

Ray Ollila, Engineer, US Forest Service (retired), PO Box 214, Beulah, WY 82712
(605-641-3081)



MISSIONARY RIDGE COMPLEX

RECREATION RESOURCE ASSESSMENT

I. OBJECTIVES

- Inventory and assess the effects of fire and suppression actions and impacts to recreation facilities
- Specify rehabilitation and replacement measures to mitigate fire and suppression impacts
- Assess the effects of fire and suppression actions on recreation opportunities at risk
- Determine the effects of fire and suppression actions to developed and dispersed recreation values at risk
- Prescribe emergency rehabilitation measures and/or monitoring

II. ISSUES

- Fire impacts to developed and dispersed recreation site facilities (toilets, tables, signs, etc.)
- Fire impacts to vegetation and soil in campgrounds
- Potential threat from hazard trees to visitor safety in areas in proximity to the fire
- Potential threat to public safety due to flash flooding

III. OBSERVATIONS

A. BACKGROUND

The purpose of this Burned Area Emergency Rehabilitation (BAER) Recreation Assessment is to document the effects of the fire, suppression activities, and proposed rehabilitation work to the developed and dispersed recreation resources on lands under the jurisdiction of the San Juan National Forest (SJNF) and the San Juan BLM Field Office. Fire and associated suppression activities often create areas that are unsafe for the public and resource managers. Recreational infrastructure such as campgrounds, trailheads, and interpretive signs may be impacted by the fire, which affects the availability and quality of the recreational experience within the burned area. There are 19 developed campgrounds on the Columbine Ranger District. Eleven campgrounds were within the burned area perimeter. Numerous dispersed camping sites and trailheads were also within the burned area perimeter.



B. RECONNAISSANCE METHODS AND RESULTS

On July 1, 2002, the BAER team assembled at the San Juan Public Lands Center to begin the assessment process. On July 5 the team members met with the recreation specialists from the Columbine RD to begin assessing the different aspects of the fire's impact on developed and dispersed recreation facilities. Field reconnaissance of the recreation facilities in the fire areas was conducted between July 5th and July 10th by driving to campgrounds and trailheads and inspecting the impacts from the fire and fire suppression activities. Aerial observation of both developed and dispersed recreation areas took place on July 9, 2002, by recreation staff on the District. Maps of burned areas and potential debris flow areas were overlaid with maps of developed and dispersed recreation sites to determine potential impacts.

C. FINDINGS

1. Developed Recreation Sites

Miller Creek Campground – Closed due to proximity of fire. Revenues lost. Nothing was burned in the campground or day-use area. Miller Creek runs through the campground and is prone to flash floods. It is a major tributary into Lemon Reservoir and is likely to deposit ash and debris into the reservoir. Materials washed down in previous flash floods were detrimental to Durango's drinking water supply. During flash floods in 1999, the creek came very close to running over it's north bank into the campground.

Upper Lemon Day Use Area – The area did not burn but was a staging area for fire and helitack crews. There is some damage to the vegetation where it was necessary for them to drive/park off roadways and down to the reservoir.

Florida and Florida Group Campgrounds – Closed due to proximity of the fire. Lost revenues. Nothing was damaged by fire in the campground. A dozer did some damage when it drove through the creek and into the campground because it exceeded the weight limit of the bridge. The river runs through the campground and has some campsites close to it. These could be susceptible to damage during a flash flood. There is a bridge over the river that must be crossed to access Florida, Florida Group, and Transfer Park campgrounds and the Burnt Timber trailhead. This bridge is scheduled to be replaced in the fall of 2002. It may not be useable and may be susceptible to washing out during a flood. Check with Engineering.

Transfer Park Campground and Burnt Timber Trailhead - Closed due to fire. Lost revenues. Fire burned up to the trailhead and campground road. Some spot fires occurred in the campground but I did not see any damage. Dozer line goes through the trailhead area and to the West. The campground water storage tanks are in that area, but the tanks or water lines were affected. There is steep terrain to the west of the campground and up the trail where erosion could occur. The Florida River is to the East of the CG and could be affected by erosion and sedimentation.

Old Timers Campground – Closed due to fire. Lost revenues. There was no fire damage in the campground. However burning occurred to the east of the campground in some steep areas. There is a small stream that runs through the campground. There could be possible erosion into the stream (and reservoir) and into the campground facilities from the steep area and private road



east of the campground.

Graham Creek Campground – Includes 25 campsites, 1 Host site, 3 toilets, drinking water system that includes a spring, water collection area, water storage tanks and 5 water hydrants and a boat ramp. This water system also supplies water to North Canyon Campground. Vegetation was burned through the entrance to the campground and in areas on the east edge of the campground. Hazard trees will need to be removed and some areas may need to be planted. Entrance signs have burned. There was no burning in the fenced spring area for the campground's drinking supply, but the water could be influenced by surface water running from burned areas above. Some valve covers for the water system have melted. The water system is very old PVC pipe, and is not buried very deep in some places. Also, heavy equipment drove through an area where lines are known to be located. The water system may be heavily damaged, but do not know for certain at this time. This water system also provides water to North Canyon CG to the north, which was even more heavily damaged. Graham Creek runs through the campground and could carry ash, sediments, and debris flows from areas above. Also, the water line crosses the campground road at the creek and has valves very close to the creek that could be damaged. If a flash flood occurs, some campsites could also be damaged.

North Canyon Campground – Includes 21 campsites, 3 toilet buildings, 4 water hydrants. Approximately ½ the vegetation burned in the CG. Water valve covers were melted and lines may have been damaged (see Graham Creek CG). One table was smashed by a fallen tree. The entrance sign and at least one other have been burned. North Canyon Creek runs through the CG and may be susceptible to erosion and debris flow.

Pine Point Campground - Includes 29 campsites, 1 Host Site, 3 toilets, plus a pumphouse and water system consisting of a well, storage tanks and 6 hydrants. One-third of the campground vegetation was burned severely. Another one-third burned with less intensity. Entrance signs plus many others burned. Two campsites, ten parking barriers, one outhouse, and a pump house burned. A new pump house with electrical panels, chlorinators, etc. could cost approximately \$30,000. This campground will be closed until burned facilities are replaced. Ash, sediment, and debris flows could occur in some of the steeper areas of the campground, potentially damaging other facilities.

Middle Mountain Campground – Closed due to proximity of fire. Nothing burned in this CG.

Vallecito Campground and Trailhead - Closed due to fire. Nothing burned in the campground. Vallecito Creek runs through the campground. Ash, sediments, and debris from upslope burned areas could impact stream courses. Areas were burned along the roadways leading into the campground, which could have debris flow problems in the future.

Pine River Campground – Includes 6 campsites, 1 toilet building, 3 hitching rails and one unloading dock. The fire burned up to and within the campground. Approximately one-fourth of the campground vegetation burned. A steep dozer line was pushed through the campground. Ash, sediment, and debris flows could enter the campground from the steep slopes above. Some big trees were burned and others could be in danger of falling from the steep slopes. A small stream runs through the campground.



2. Dispersed Recreation Sites

Beri Park – This is a popular dispersed recreation area on the Middle Mountain road. This area may have burned and may have to be closed due to fire impacts and safety concerns.

Wallace Lake – This is a heavily used concentrated dispersed camping area along the Missionary Ridge road that was heavily burned.

Bear Park – This is also a heavily used dispersed camping area along Missionary Ridge Road that was heavily burned.

3. Developed Recreation Values at Risk

On the Columbine Ranger District, 11 out of 19 Developed Recreation Camping Areas were closed due to the fire. These areas are operated by a concessionaire through a Special Use Permit. A lot of revenues were lost during the fire due to these areas being closed. These opportunities will not be available for an extended period of time since much of the burned area will not be safe for public entry and will remain closed.

All 11 developed campgrounds within the burned area have burned and dead trees either on the access routes to the campgrounds, within the campgrounds, or in forested areas adjacent to the campgrounds.

Specific developed campgrounds at risk from potential ash and debris flows include Pine Point, North Canyon, and Graham Creek Campgrounds.

There is definitely a visitor safety issue in the campgrounds that burned. These will not be reopened until hazard trees are removed and the area is safe for public use. We will attempt to open campgrounds that were not burned, but will look at all safety factors associated with use of the areas. These include road access to the area, flooding and debris flow potential into open areas that could block access in and out of those areas, and unsafe conditions adjacent to the campgrounds where it will be difficult to keep the public out.

4. Dispersed Recreation Values at Risk

Hunting is a very popular activity in the Weminuche Wilderness, along Middle Mountain road, East Florida road, and the Missionary Ridge area. The areas will likely be closed for the 2002 hunting season, which will affect access and hunting activities in these areas.

There is definitely a visitor safety issue in the dispersed recreation areas that burned. These will not be reopened until hazard trees are removed and the areas are safe for re-entry. We will attempt to open dispersed areas that were not burned, but will look at the safety of road access to the area and flooding and debris flow potential. Any hazards or unsafe conditions existing adjacent to the dispersed camping areas will necessitate keeping these areas closed.

Other lost recreation opportunities in the area include: picnicking, hiking, mountain biking, backpacking, fishing, boating, horseback riding, OHV use, sightseeing and dispersed camping. These opportunities will not be available for an extended period of time until the burned area is safe for re-entry by the public.



IV. RECOMMENDATIONS

A. MANAGEMENT (Emergency Actions)

1. Rehabilitate hand line, dozer line and crew movement areas in developed recreation sites (Transfer Park, Graham Creek, North Canyon, Pine Point, and Pine River).
2. Close developed recreation sites to the public that have been burned and need replacement facilities, have hazard trees within or adjacent to the campground, or are in a potential debris flow area. The developed campgrounds in most danger of potential debris flow include North Canyon, Graham Creek and Pine Point Campgrounds.
3. Sign developed and dispersed recreation sites for potential hazards to the public.
4. An assessment of hazards adjacent to campgrounds will determine whether other campgrounds will be closed. Determine all potential hazard trees and cut them before any developed recreation sites are reopened.
5. Determine all road access routes to developed and dispersed recreation sites that are within potential debris flow areas and mitigate these areas.

B. MANAGEMENT RECOMMENDATIONS (Long-term, No Specifications)

1. Replace all developed and dispersed recreation facilities that were damaged by the fire.

V. CONSULTATIONS

NAME	AGENCY	TITLE	PHONE NUMBER
Paul Peck	San Juan National Forest, San Juan Public Lands Center	Forest Level Recreation Staff	(970) 385-1209
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Nancy Berry, Recreation Specialist, San Juan National Forest, Columbine Ranger District, Durango, CO 81301.





MISSIONARY RIDGE COMPLEX

NOXIOUS AND INVASIVE WEED ASSESSMENT

I. OBJECTIVES

- Determine treatment (direct and indirect) and monitoring needs of areas where noxious weeds are present and/or believed to be invading.
- Detect noxious weed locations within the burned area and areas of high infestations near the burned areas.
- Prioritize which species have the highest potential to cause substantial and persistent long-term degradation of ecosystem function.
- Design restoration activities to minimize import and establishment of noxious weeds and invasive non-native plants.

II. ISSUES

- Suppression effects and short/long-term impacts to resources from invasive and noxious weed species.
- Monitoring of impacted lands for the early detection and control of invasive and noxious weed species.
- Complex land jurisdictions within the burned area for mapping and treatment of invasive and noxious weed species.
- Determining most threatening invasive species to native vegetation.

III. OBSERVATIONS

The Missionary Ridge Complex, consists of the Missionary Ridge Fire West, the Missionary Ridge Fire East and the Valley fire. The Valley fire was mainly of private land, while both Missionary Ridge fires were predominately on NFS land. There is, however, a complex of land jurisdictions within the burned area consisting of National Forest Systems, Bureau of Land Management, Bureau of Reclamation, La Plata County, Archuleta County, and privately owned lands. The lands of other jurisdictions adjacent to NFS lands increase the complexity of managing noxious and invasive weeds on NFS lands.

Many of the private lands adjacent to the burned areas have established noxious weed populations including, but not limited to: musk thistle, houndstongue, Canada thistle, yellow toadflax, Russian knapweed, bull thistle, scotch thistle, whitetop, leafy spurge and chicory. During the suppression efforts, vehicles and heavy equipment moved onto public land from the weed infested private and county lands. Many vehicles and heavy equipment used on the fire were from all over the country, potentially carrying noxious weed seed and increasing the potential for noxious weed infestations by at least 30%. Dozer lines and hand lines created during the suppression efforts are expected to further



increase the potential for noxious and invasive weed infestations. NFS roads, county roads and NFS trails are expected to continue to contribute to the spread of noxious weeds.

The Missionary Ridge Complex has created a favorable seedbed to establish noxious weed populations, especially in severely burned areas. Noxious weeds will establish quickly in areas that will take native vegetation much longer to establish, taking advantage of the resources (soil nutrients, soil moisture) with little competition.

IV. FIELD OBSERVATIONS AND FINDINGS

- A.** Field reconnaissance of the burned area was conducted between July 3rd and July 7th to evaluate burn intensity, determine and document losses of vegetation and to determine areas of potential infestations of noxious weeds. Established noxious weed populations within the burned area have been mapped using GPS units. County and private lands surrounding three-fourths of the fire perimeter have established noxious weed populations that have been identified through mapping and coordination with the La Plata county extension office weed manager. Dozer lines built during the suppression efforts are being recorded with GPS units as well as hand lines to monitor for new weed invasions. FS roads, FS trails and county roads have been surveyed and locations of existing weed populations have been recorded with GPS units to facilitate monitoring of their spread into the burned areas.

V. RECOMMENDATIONS

A. MANAGEMENT

1. Reseed severely burned areas with noninvasive annual grasses and perennial native grasses to reduce the potential for noxious and invasive weeds establishment.
2. Use integrated weed management practices, in accordance with *Environmental Assessment for the Management and Control of Noxious Plants on the San Juan/Rio Grande National Forests, USDA Forest Service, July 1996* to provide timely treatments of noxious and invasive weeds.
3. Identify and treat species with the highest potential to cause substantial and persistent long-term degradation of ecosystem function. These species include, but are not limited to: yellow toadflax, scotch thistle, and Russian knapweed.
4. Use weed free sources of mulch and erosion materials.
5. Select natives or non-invasive introduced species. Provide for random testing of seed to verify the absence of noxious weed seed.

6. Monitor and treat areas within the perimeter of the fire adjacent to known private land weed infestations.

PRIVATE LAND AREA	INFESTED ACRES	WEEDS PRESENT
Vallecito Reservoir area	15,000	Houndstongue, musk thistle, Russian knapweed, Canada thistle, whitetop
Lemon Reservoir area	10,000	Houndstongue, musk thistle, Russian knapweed, Canada thistle, whitetop
CR 240	5 (along 12 miles of road)	Houndstongue, musk thistle, Russian knapweed, Canada thistle, whitetop, yellow toadflax, scotch thistle, bull thistle, chicory
CR 250	6 (along 15 miles of road)	Houndstongue, musk thistle, Russian knapweed, Canada thistle, whitetop, yellow toadflax, scotch thistle, bull thistle, chicory

7. Monitor and treat known disturbed soil locations that occurred during fire suppression efforts.

DISTURBANCE	DISTANCE/AREA	WEEDS KNOWN	ACRES
Dozer lines	103.3 miles	Houndstongue, musk thistle, yellow toadflax, Russian knapweed, Canada thistle, whitetop, scotch thistle, bull thistle	1500
Hand lines	14.4 miles	Houndstongue, musk thistle, yellow toadflax, Russian knapweed, Canada thistle, whitetop, scotch thistle, bull thistle	150
Helispots/ Safety zones	15@ 3 acres each	Houndstongue, musk thistle, yellow toadflax, Russian knapweed, Canada thistle, whitetop, scotch thistle, bull thistle	45
Trails	52 miles	Houndstongue, musk thistle, yellow toadflax, Russian knapweed, Canada thistle, whitetop	200
Roads	123 miles	Houndstongue, musk thistle, yellow toadflax, Russian knapweed, Canada thistle, whitetop,	



scotch thistle, bull thistle

1800

B. MONITORING

1. Identify and monitor areas of concentrated human or animal activity prior to the fire where new weed infestations are likely to occur.
2. Identify and monitor severe ground disturbance due to fire suppression activities, such as dozer lines, hand lines, safety zones, staging areas, heliports, etc.
3. Identify and monitor areas, including private and county lands, that had weed populations prior to the fire to detect density and spatial growth of populations.
4. Monitor areas for three years for the presence and persistence of invasive species and treat as required.

Jennifer Rowe, Rangeland Management Specialist, San Juan National Forest, Columbine Ranger District, Durango, CO 81301

MISSIONARY RIDGE COMPLEX

WILDERNESS RESOURCE ASSESSMENT

I. OBJECTIVES

- Inventory and assess fire suppression impacts to the Wilderness resource
- Specify rehabilitation and replacement measures to mitigate fire and suppression impacts
- Protect the wilderness character during rehabilitation efforts
- Utilize Minimum Impact Management Techniques for rehabilitation in most situations

II. ISSUES

- Public Safety
- Erosion
- Wilderness Values
- Old vehicle routes obliterated
- Rehabilitate all roads, fire lines, spike camps, helipads and staging areas to pre-fire conditions
- Fire impacted wilderness signing to include trailhead bulletin boards, registration boxes and any interior signage
- Fire and suppression impacts to wilderness trails
- Potential for vehicular access into the Wilderness (motorized and mechanized) due to fire or suppression efforts

III. OBSERVATIONS

A. BACKGROUND

The Piedra Area, while not officially designated as Wilderness, is a congressionally designated area to be managed so as to retain its existing wilderness character. The Piedra Area is 60,387 acres and is situated at lower elevations than other Wilderness areas on the San Juan National Forest. It encompasses large tracts of ponderosa pine communities and mixed conifer stands. The Columbine Ranger District manages 7,000 acres of the Piedra Area.

The Weminuche Wilderness Area (499,771 acres) stretches across the Continental Divide on the San Juan and Rio Grande National Forests. The Weminuche contains three 14,000-foot peaks and many 13,000-foot peaks, and is one of the most visited Wilderness areas in Colorado. It's an area of rugged mountains, valleys, and lakes with about 500 miles of trail. The Columbine Ranger District manages



230,000 acres of the Weminuche Wilderness, 14 trailheads, three 14,000-foot peaks, and 200 plus miles of trails. The Durango and Silverton Narrow Gauge Railroad provides a unique entry to the wilderness at 2 trailhead locations on the District.

The purpose of the Burned Area Emergency Rehabilitation (BAER) Wilderness Assessment is to document the effects of the fire itself, suppression activities, and proposed rehabilitation work in the Weminuche Wilderness and the Piedra Area on lands under the jurisdiction of the San Juan National Forest (SJNF). Fire and suppression activities create areas that may be unsafe for the public and scars to the landscape that will require rehabilitation monitoring to return it to pre-fire conditions. The fire may influence the wilderness users experience within the burned areas.

B. RECONNAISSANCE METHODS AND RESULTS

On July 1-6, 2002, the Wilderness Resource Advisor assigned to the Missionary Ridge Fire assessed the impacts from the fire and suppression activities within the Piedra Area and the Weminuche Wilderness through field reconnaissance. Recreation staff assessed 3 of the 6 trailheads that access the Weminuche within the burned area on July 5, 2002 and conducted aerial observation of the fire on July 9, 2002.

C. FINDINGS

Within the Piedra Area, approximately 5000 acres burned. There were impacts to segments of the East Creek trail (#535), non-system trails behind private property, and an old two-track road made into a dozer line. The impacts consisted of high burn intensity to the vegetation adjacent to and on the trail, trail tread no longer compacted, and the trail being widened by All Terrain Vehicle (ATV) use. Approximately 6.5 miles of dozer line was constructed along with 17 miles of hand line within the area. Located within the Piedra Area were three spike camps, a parking area, and vehicular traffic impacts along trails and meadows.

Within the Weminuche Wilderness Area, approximately 5900 acres burned. There is soil and vegetation disturbance adjacent to and within the trail tread of Lake Eileen trail (#899). The vegetation is severely burned in places and erosion will follow. Dozer line intrusions (approximately one mile) occurred along the west side of County Road 500 where the wilderness boundary is next to private property, and along the southern boundary between Grassy Mountain and Indian Mountain. Approximately 4 miles of handline was constructed west of CR 500 and northeast of Blodgett Creek (north of Lemon Reservoir), with half of it in extremely steep terrain. Some "clearing" of an area along Fall Creek was done to prevent fire spread east across the creek.

IV. RECOMMENDATIONS

A. MANAGEMENT

1. Piedra Area

In the Piedra Area, the existing Management Area Prescriptions for the section affected by the fire fall within "Pristine" and "Primitive" designations. The desired condition for fire under "pristine" and "primitive" prescriptions states; "Fire management activities are designed to retain the natural character of the ecosystem. Evidence of the effects of fire may be present. Minimize fire suppression impacts in wilderness by implementing minimum impact suppression tactics." Pages II-26, 29 & 32 (Wilderness Management Direction). The following fire rehabilitation needs were identified.

Dozer lines

- The 6.5 miles of dozer line will be rehabilitated utilizing heavy equipment to rip, pull in berms, water bar, seed, and place downed logs, etc. to effectively obliterate control lines.
- Monitoring will be required to determine if the rehab efforts are successful.
- If not successful, additional weed-free seeding and naturalization will be necessary to meet the desired condition of "Human influence on vegetation is *unnoticeable* in "pristine" to *minimal* in "primitive". Plant species are *indigenous* to the immediate area for "pristine" and are *predominately native and indigenous* to the immediate area in a "primitive" prescription. Pages II-29, 32, (Wilderness Management Direction)

Spike Camps

- Three spike camps will require rehabilitation efforts.
- This will require monitoring for recovery of the meadows, which is dependant upon future moisture and the resiliency of the vegetation.
- If camp areas do not recover within a year from moisture and non-use, scarification utilizing hand tools and seeding with indigenous species in the meadows (camp areas) will be necessary.
- The staging area in Lion Creek where vehicular use occurred, needs to be aerated and seeded where the soil is compacted and vegetation is sparse to non-existent. It should be returned to its pre-fire condition.
- Inspection will be required to ensure all trash, equipment, supplies, and flagging shall be removed from camp areas, control lines, and any flagged travel routes.

Hand lines

- Fire hand lines (17 miles) will be rehabilitated to pre-fire conditions.
- Berms created during line construction will be obliterated by pulling material back onto the line and vegetative debris will be scattered over the line to blend it with the surrounding natural landscape.
- Water bars will need to be constructed as appropriate as per the following chart.

Hand Line Water-bar Spacing

Line Grade (%)	Maximum Spacing (feet)
6-9	400
10-14	200
15-24	100
25+	50



If the fire lines are visible from existing trails, they will need to be barricaded and disguised to prevent use as travel corridors. Trees that were cut during suppression activities that are visible will need to be re-cut as close as possible to ground level and camouflaged by rubbing stumps with dirt or ash. If this does not work, signing may be needed.

The Piedra Area boundary needs to be surveyed from Indian Mountain east two miles and north approximately 4 miles to Slide Mountain. Signing will be required along this boundary where the dozer or hand lines could entice unauthorized uses (motorized or mechanized). Trailhead signing that was destroyed needs to be replaced.

The East Creek trail will remain closed to public use until it is safe from hazard trees. Wait for one season, until spring/summer 2003, to allow time for snags to fall from wind and snow. After this time period, cut burned snags that would fall into the trail or campsites. When cutting, cut as low to the ground as possible and camouflage the stump with dirt or ash. Consider the use of explosives for snag mitigation.

2. Weminuche Wilderness

In the Weminuche Wilderness, the existing Management Area Prescriptions for the areas affected by the fire fall within "Pristine", "Primitive" and "Semi-Primitive" designations. The desired condition for fire under "pristine", "primitive" and "semi-primitive" prescriptions states; "Fire management activities are designed to retain the natural character of the ecosystem. Evidence of the effects of fire may be present." Minimize fire suppression impacts in Wilderness by implementing minimum impact suppression tactics." (Pages II-26, 29 & 32, Wilderness Management Direction). The following fire rehabilitation needs were identified.

- Snag removal adjacent to Lake Eileen trail (#899) and campsites in the area should be done after the area is given time for the snags to fall. The trail should be closed until 2003.
- Felling of hazard trees should be done with crosscut saws, trees cut as low to the ground as possible, and stumps camouflaged with dirt or ash.
- Dozer line intrusions adjacent to private property along the west side of CR 500 need to be surveyed and signed to prevent unauthorized intrusions into the wilderness (motorized and mechanized). Areas where there is potential for these types of activities will be physically blocked through large boulder placement, possibly gates, and signing.
- The clearing of approximately 2 acres of trees in Fall Creek needs to be inspected and possibly naturalized.

3. Piedra Area and Weminuche Wilderness

- Signing will be used when necessary to post closed areas, boundaries, and other needed messages. Install interpretive signing where appropriate.
- Any noxious weeds growing in the rehabilitated dozer lines, spike camps, or hand lines will be treated immediately using Agency policy and direction for wilderness.
- All hand lines will be monitored for successful rehabilitation.



- If not successful, new measures will be taken to include additional waterbars, native weed-free seeding, and naturalization.

V. CONSULTATIONS

NAME	AGENCY	TITLE	PHONE NUMBER
Paul Peck	San Juan National Forest, San Juan Public Lands Center	Forest Staff Recreation/ Wilderness	(970) 385-1209
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VI. REFERENCES

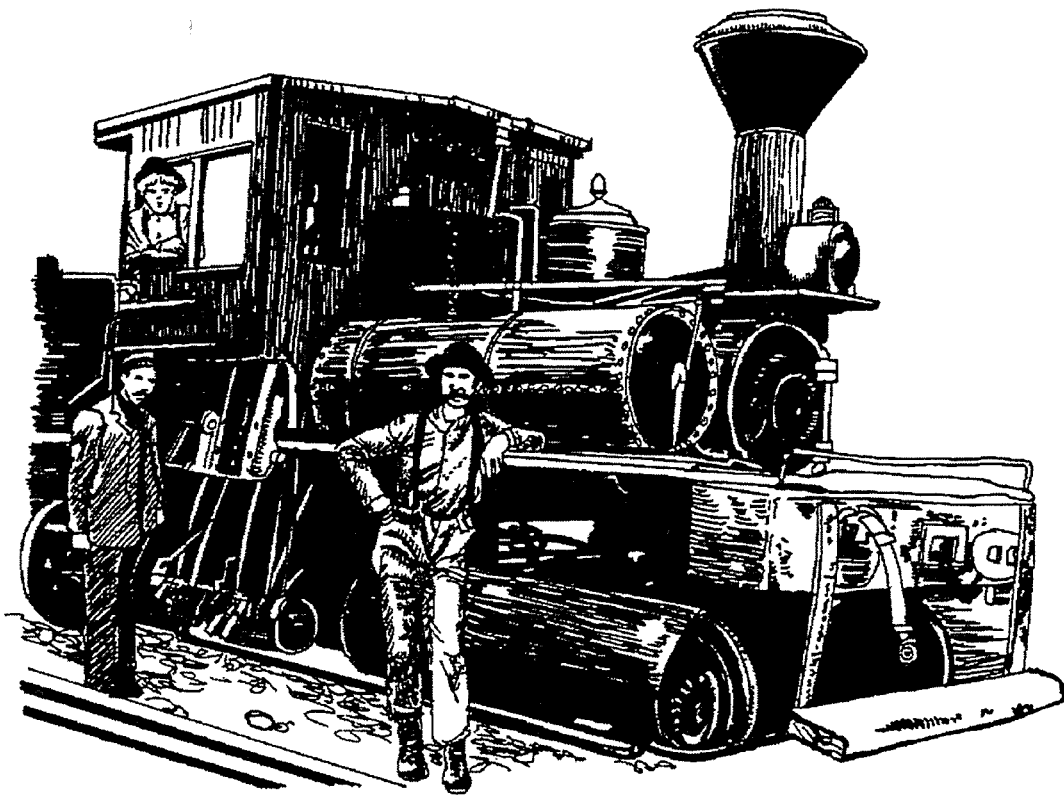
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Nancy Berry, Wilderness Specialist, Columbine Ranger District and BLM Field Office, San Juan National Forest and BLM Resource Area, (970) 375-3304



Appendix II. Environmental Compliance

- Environmental Compliance Considerations, Documentation, and Consultations
- NEPA Categorical Exclusion Documentation and Decision



Historic Railroad
Carol Ziebart, *U.S. Forest Service*



APPENDIX II - ENVIRONMENTAL COMPLIANCE CONSIDERATIONS

A. Federal, State, and Private Lands Environmental Compliance Responsibilities

All projects proposed in the Missionary Ridge Complex Interagency Burned Area Emergency Stabilization and Rehabilitation (BAER) Plan that are prescribed, funded, or implemented by Federal agencies on Federal, State, or private lands are subject to compliance with the *National Environmental Policy Act* (NEPA) in accordance with the guidelines provided by the *Council on Environmental Quality (CEQ) Regulations (40 CFR 1500-1508)*. This Appendix documents the Interagency BAER Team considerations of NEPA compliance requirements for prescribed rehabilitation and monitoring actions described in this plan for all jurisdictions affected by the Missionary Ridge Complex burned area emergency.

While this plan may identify potential timber salvage issues, in strict compliance with the Department of the Interior and Department of Agriculture Burned Area Emergency Stabilization and Rehabilitation policy, this plan does not propose nor authorize non-emergency actions such as timber salvage. Therefore, environmental analysis and compliance documentation for any proposed timber salvage must be completed by the Bureau of Land Management and the U.S. Forest Service separately from this environmental compliance documentation. Any stabilization or rehabilitation actions such as changing fence lines when replacing burned fences or any other stabilization projects will require the normal BLM planning and review process with clearances and NEPA documentation.

This plan has been developed by an Interagency BAER Planning Team comprised of representatives from the: U.S. Department of the Interior (DOI), Bureau of Land Management (BLM); U.S. Department of Agriculture (DOA), Forest Service (USFS); .

Agency Specific Guidance: This NEPA documentation has been developed in accordance with the following agency specific guidelines.

U.S. Forest Service: Emergency rehabilitation actions proposed on U.S. Forest Service lands within the San Juan National Forest, must comply with NEPA compliance guidelines contained in *Forest Service Handbook 1909.15, (Chapter 30 and 31 and 36 CFR 219)*.

B. Related Plans and Cumulative Impacts Analysis

San Juan National Forest Plan: The BAER Team Environmental Protection Specialist reviewed the *San Juan National Forest Plan and Environmental Assessment*, and in consultation with the U.S. Forest Service NEPA coordinator determined that actions proposed in the Missionary Ridge Complex BAER Plan are within the boundary of the San Juan National Forest are consistent with the management objectives established in the Forest Plan and U.S. Forest Service best management practices for emergency watershed stabilization and rehabilitation.

Cumulative Impact Analysis: Cumulative effects are the environmental impacts resulting from the incremental impacts of a proposed action, when added to other past, present, and reasonably foreseeable future actions, both Federal and nonfederal. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time. The emergency protection and rehabilitation treatments for the watersheds affected by the Missionary



Ridge Complex, as proposed in the Missionary Ridge Complex BAER Plan, do not result in an intensity of impact (*i.e.* major ground disturbance, etc.) that would cumulatively constitute a significant impact on the quality of the environment. The treatments are consistent with the above jurisdictional management plans and associated environmental compliance documents, the best management practices of the U.S. Forest Service as detailed under Nationwide Permit - 37, and categorical exclusions listed below.

No direct or indirect unavoidable adverse impacts to the biological or physical environment would result from the implementation of the Missionary Ridge Complex BAER Plan. The implementation of emergency watershed protection and rehabilitation treatments of actions proposed in the plan would not result in any adverse effect on the burned area or areas downstream. Conversely, implementation of the plan would be expected to result in a cumulatively beneficial effect by reducing the extent and intensity of potential flooding downstream of the burned area.

C. Agency and Public Scoping

Multi-Agency Scoping: Upon arrival at the Missionary Ridge Complex the Interagency BAER Team requested a meeting for affected agencies to be briefed on process and procedures relevant to the BAER process. Representatives of all affected jurisdictions detailed above will be able to review the proposed recommendations from the BAER Team at the agency closeout. Each of the specifications within this plan have been reviewed and approved by the Group.

Technical Scoping: Upon arriving at the Missionary Ridge Complex incident BAER Team Technical Specialist immediately consulted with local agency technical specialist to scope issues of concern, and develop a mutually agreed approach to the assessment of resources damages, analysis of findings, and development of recommendations. All specifications and resource assessments were development and approved after extensive consultation with and review by local technical specialist for all affected agencies.

Public Scoping: Public scoping and review was further facilitated by the Type I Team Information Officers disseminating new articles and web page information about the Missionary Ridge Complex BAER issues and objectives. The Type I Team Information Officers also made visits to all residents within the Missionary Ridge Fire Complex.

D. Applicable Laws and Executive Orders

This section documents consideration given to the requirements of specific environmental laws in the development of the Missionary Ridge Complex BAER Plan. Specific consultations initiated or completed during development and implementation of this plan are also documented. The following executive orders and legislative acts have been reviewed as they apply to the Missionary Ridge Complex BAER Plan

1. **National Historic Preservation Act (NHPA).** The BAER Team archeologist has initiated necessary consultation with the Colorado State Historic Preservation Office (SHPO) and the pertinent tribes regarding activities proposed within the Missionary Ridge Complex BAER plan.
2. **Executive Order 11988, Floodplain Management.** All proposed treatments are in compliance with this order.

3. **Executive Order 11990, Protection of Wetlands.** All proposed treatments are in compliance with this order.
4. **Executive Order 12372, Intergovernmental Review.** Coordination and consultation is ongoing with affected Tribes, Federal, State, and local agencies. A Copy of the BAER plan will be disseminated to all affected agencies.
5. **Executive Order 12892, Federal actions to address Environmental Justice in Minority and Low-Income Populations.** All Federal actions must address and identify, as appropriate, disproportionately high and adverse human health or low-income populations, and Indian Tribes in the United States. The BAER team has determined that the actions proposed in this plan will result in no adverse human health or environmental effects for minority or low-income populations and Indian Tribes.
6. **Endangered Species Act.** The BAER Team wildlife biologist and vegetation specialist have consulted with the U.S. Fish and Wildlife Service and Local Game and Fish Agencies regarding actions proposed in this plan and potential affects on Federally and State listed species and have determined that there is no effect. Individual agencies are responsible for continued consultations during plan implementation.
7. **Clean Water Act.** All proposed treatments are in compliance with this Act. Restoration and Rehabilitation measures proposed are necessary to maintain clean water within the burn and adjacent areas. Long-term impacts are considered beneficial to water quality.
8. **Clean Air Act.** Federal Ambient Air Quality Primary and Secondary Standards are provided by the National Ambient Air Quality Standards, as established by the U.S. Environmental Protection agency (EPA) (Clean Air Act, 42 U.S.C. 7470, et seq., as amended). The BAER team has determined that treatments prescribed in the Missionary Ridge Complex area will have short-term minor impacts to air quality that would not differ significantly from routine land use practices for the area. Long-term treatments proposed in the plan would be expected to have a beneficial impact to air quality through stabilization of ash and soils within the Missionary Ridge Complex area.

E. Applicable and Relevant Categorical Exclusions

U.S. Forest Service: The individual actions proposed in this plan for San Juan National Forest lands are Categorically Excluded from further environmental analysis as provided for in the Department of Agriculture, Forest Service Handbook 1909.15, Chapter 30 and 31. All applicable and relevant Department and Agency Categorical Exclusions are listed below. Categorical Exclusion decisions were made with consideration given to the results of required emergency consultations completed by the BAER Team and documented in Section E below.

FSH 1909.15, 31.1a(3)

Inventory, research activities, and studies such as resource inventories and routine data collection when such actions are clearly limited in context and intensity.



FSH 1901.15, 31.1a(6)	Activities which are advisory and consultative to other agencies and public and private entities, such as legal counseling and representation.
FSH 1909.15, 31.1b(1)	Orders issued pursuant to 36 CFR Part 261 - Prohibitions to provide short-term resource protection or to protect public health and safety.
FSH 1909.15, 31.1b(4)	Repair and maintenance of roads, trails, and land line boundaries.
FSH 1909.15, 31.2(1)	Construction, reconstruction, closure or obliteration of trails.
FSH 1909.15, 31.2(5)	Regeneration of an area to native tree species, including sites preparation which does not involve the use of herbicides or result in vegetation type conversion.
FSH 1909.15, 31.2(6)	Timber stand and/or wildlife habitat improvement activities which do not include the use of herbicides or do not require more than one mile of low standard road construction.

F. Statement of Compliance for the Missionary Ridge Complex Burned Area Emergency Rehabilitation Plan

This section documents considerations given in development of the Missionary Ridge Complex BAER Plan to the requirements of specific environmental laws. Specific consultations initiated or completed during development and implementation of this plan are also documented. The above mentions executive orders and legislative acts have been reviewed as they apply to the Missionary Ridge Complex BAER Plan.

G. Consultations

- Colorado State Forest Service
- Colorado Department of Fish and Wildlife
- U.S. Fish and Wildlife Service
- Natural Resource Conservation Service
- County Representatives
- U.S. Forest Service
- Bureau of Land Management
- U.S. Geological Survey
- County Extension Service – Colorado



ENVIRONMENTAL COMPLIANCE DOCUMENTATION & DECISION

Missionary Ridge Complex Burned Area Emergency Stabilization and Rehabilitation Plan

NEPA CHECKLIST: If any of the following exception applies, the project cannot be Categorical Excluded and an Environmental Assessment (EA) is required.

(Yes) (No)

- ☐ ☒ Adversely affect Public Health and Safety
- ☐ ☒ Adversely affect historic or cultural resources, wilderness, wild and scenic rivers, aquifers, prime farmlands, wetlands, floodplains, ecologically critical areas, or Natural Landmarks.
- ☐ ☒ Have highly controversial environmental effects.
- ☐ ☒ Have highly uncertain environmental effects or involve unique or unknown environmental risks.
- ☐ ☒ Establish a precedent resulting in significant environmental effects.
- ☐ ☒ Relates to other actions with individually insignificant but cumulatively significant environmental effects.
- ☐ ☒ Adversely affects properties listed or eligible for listing in the National Register of Historic Places.
- ☐ ☒ Affect a species listed or proposed to be listed as Threatened or Endangered.
- ☐ ☒ Threaten to violate any laws or requirements imposed for the protection of the environment such as Executive Order 1198 (Floodplains Management) or Executive Order 11990 (Protection of Wetlands).

NATIONAL HISTORIC PRESERVATION ACT

Ground Disturbance:

- ☐ None
- ☒ Ground disturbance did occur and an archeologist survey, required under section 110 of the NHPA has been or will be performed. A report has been prepared by the prepared by the BAER Team archeologist. Clearance documentation is attached.

A NHPA Clearance Form:

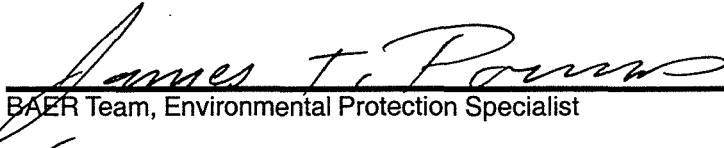
- ☐ Is required because the project affects a site that is eligible or on the national register. The clearance form is attached. SHPO has been consulted under Section 106 (see Cultural Resource Assessment, Appendix I).
- ☐ Is not required because the project has no potential to affect cultural resources (initial of cultural resource specialist).

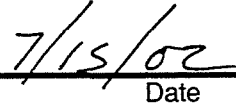
OTHER REQUIREMENTS

(Yes) (No)

- ☒ ☐ Does the project have potential to affect any Native American uses? If so, consultation with affiliated tribes is needed (see Cultural Resource Assessment, Appendix I).
- ☐ ☒ Are any toxic chemicals, including pesticides or treated wood, proposed for use? If so, local agency integrated pest management specialists must be consulted.

I have reviewed the proposals in the Missionary Ridge Complex Burned Area Emergency Stabilization and Rehabilitation Plan in accordance with the criteria above and have determined that the proposed actions would not involve any significant environmental effect. Therefore it is categorically excluded from further environmental (NEPA) review and documentation. BAER Team technical specialists have completed necessary coordination and consultation to insure compliance with the National Historic Preservation Act, Endangered Species Act, Clean Water Act and other Federal, State and local environmental review requirements.


 BAER Team, Environmental Protection Specialist

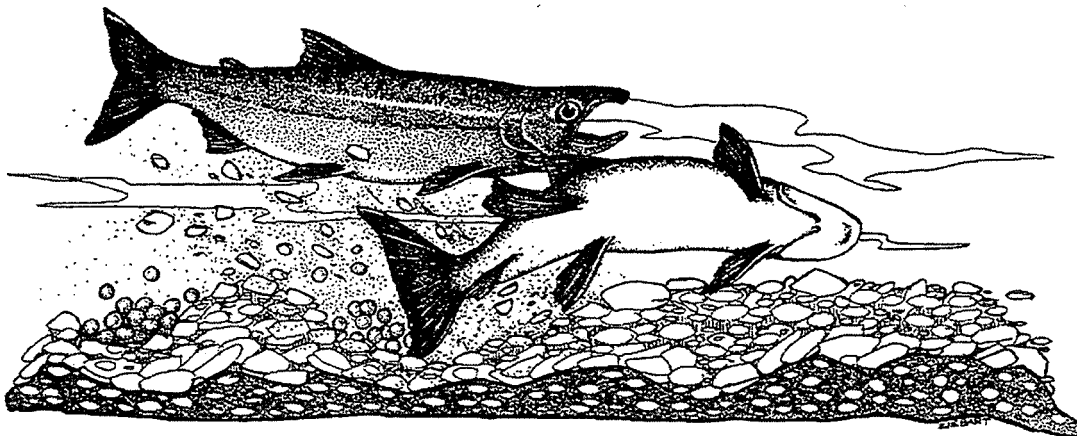

 Date

- ☒ I concur and it is my decision to approve the plan.
- ☐ I do not concur because...



Appendix III. MAPS OF FIRE AREA

- **Burn Severity**
- **Burn Intensity**
- **Precipitation Gauges**
- **Debris Flows and Flooding Hazards**
- **Values at Risk**
- **Pre-Burn Vegetation**
- **Predicted Post-Burn Vegetation**
- **Pre-Burn Wildlife Habitat Structural Stages**
- **Post-Burn Wildlife Habitat Structural Stages**
- **Seeding Areas**
- **Hillslope Treatments**



Fish
Carol Ziebart, U.S. Forest Service

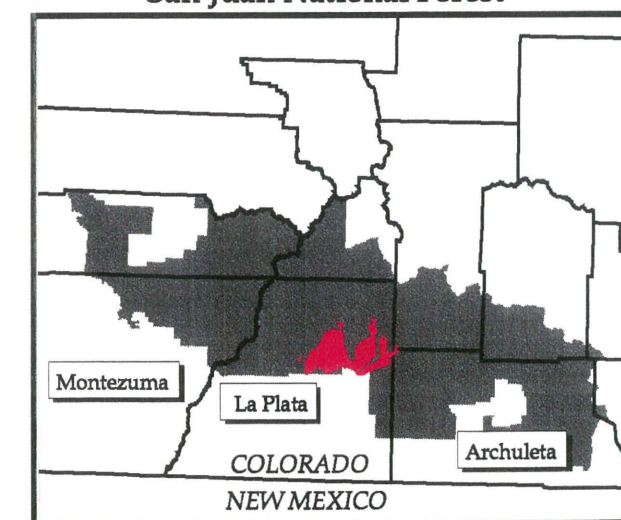
Missionary Ridge Complex Burn Severity Map

Legend

- Burn Severity**
-  Unburned
 -  Low
 -  Moderate
 -  High
 -  Lakes
 -  Fire Perimeters 1 July 2002
 -  Durango City Limits
 -  Roads

Scale 1:126720  Miles 

Locator Map San Juan National Forest



USGS
science for a changing world



Missionary Ridge Complex Burn Intensity Map

Burn Intensity	Acres
Unburned	14732
Low	22503
Moderate	17708
High	17479

Legend

Burn Intensity

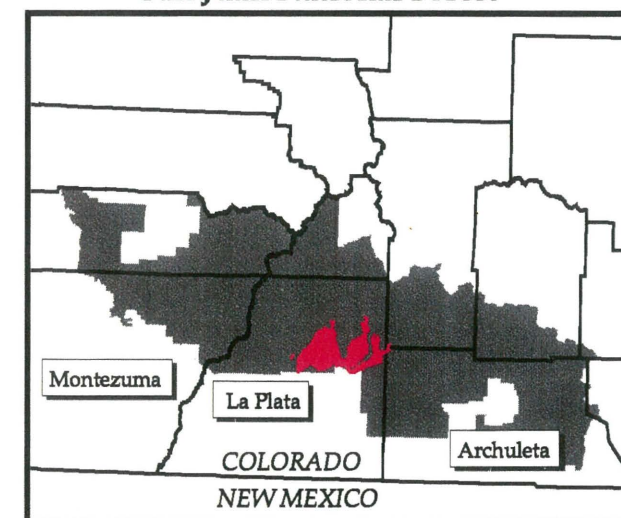
- Unburned
- Low
- Moderate
- High
- Lakes
- Fire Perimeters 1 July 2002
- Durango City Limits
- Roads

Scale 1:126720

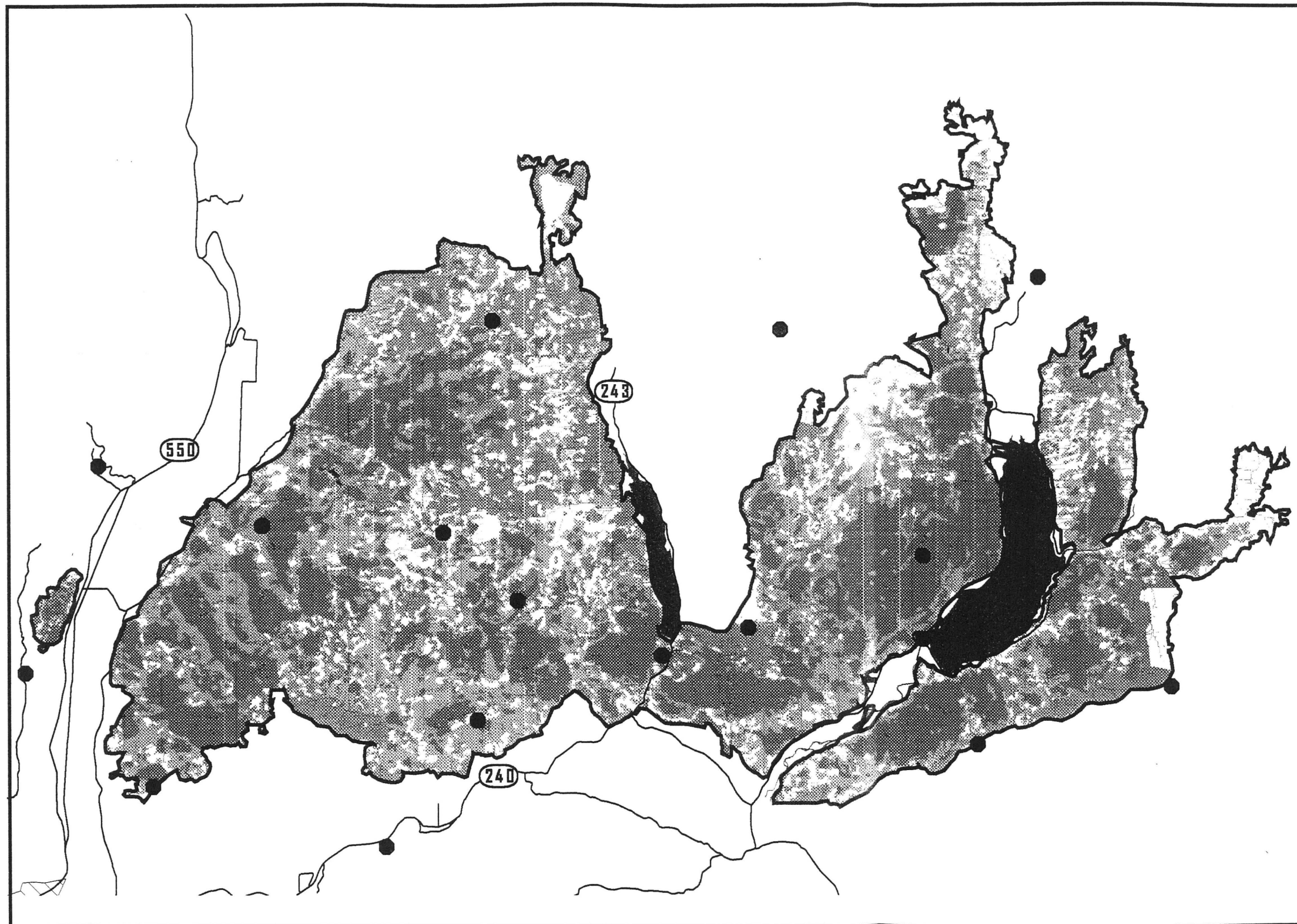
1 0 1 2 Miles



Locator Map San Juan National Forest

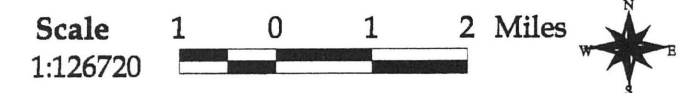


Missionary Ridge Complex Early Warning Precipitation Stations

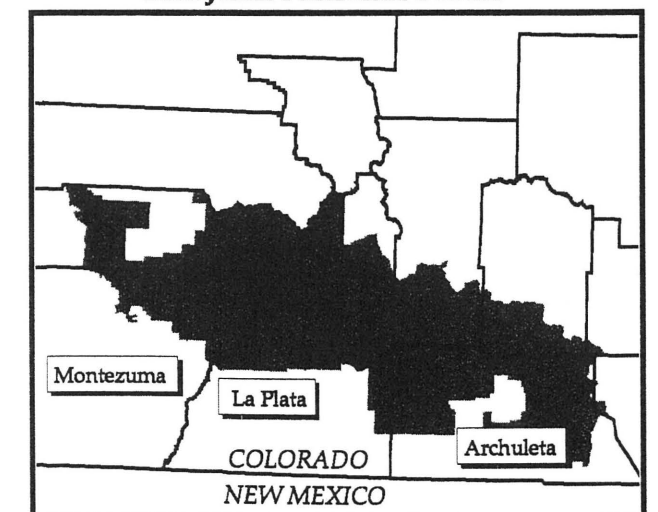


Legend

- USGS Existing Precip Gauges
- Planned Installation of Precip Gauges
- Major Roads
- Fire Perimeter
- Lakes
- Streams
- Burn Severity
 - Unburned
 - Low
 - Moderate
 - High
- Durango City Limits



Locator Map San Juan National Forest



Missionary Ridge Complex BAER Team

Missionary Ridge Complex

Debris Flow and Flooding Hazards

Legend

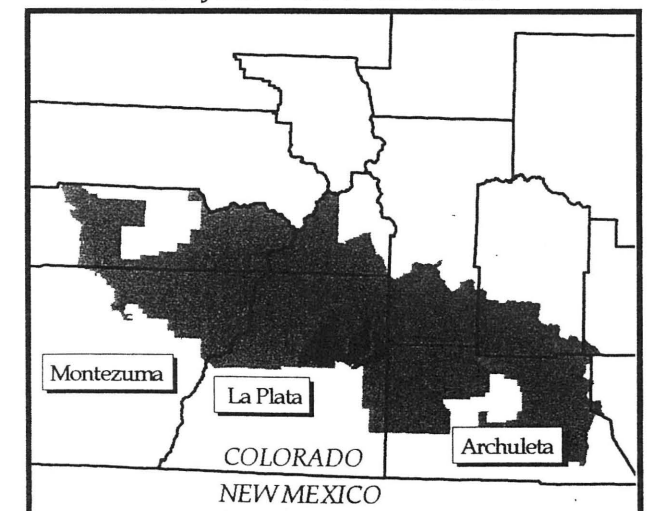
Debris Flow Hazards

-  <50,000 cubic yards
-  50,000-100,000 cubic yds
-  100,000-500,000 cubic yards
-  > 500,000 cubic yards
-  Potential Debris Flow Source Areas
-  Flood Zones
-  Missionary Ridge Complex Perimeter
-  Lakes
-  Roads
-  Streams

Scale 1 0 1 2 Miles
1:126720



Locator Map San Juan National Forest



Missionary Ridge Complex

Values at Risk

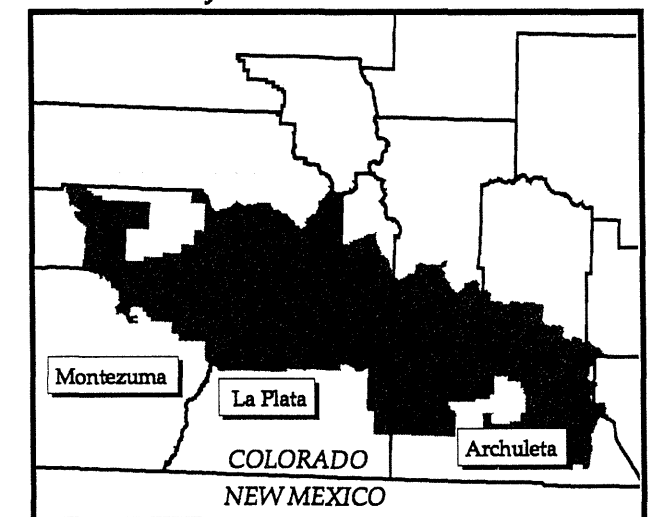
Legend

- Values at Risk
- Watersheds at Risk
- Potential Debris Flow Sources
- Missionary Ridge Complex Perimeter
- Lakes and Streams
- Roads

Scale 1 0 1 2 Miles
1:126720



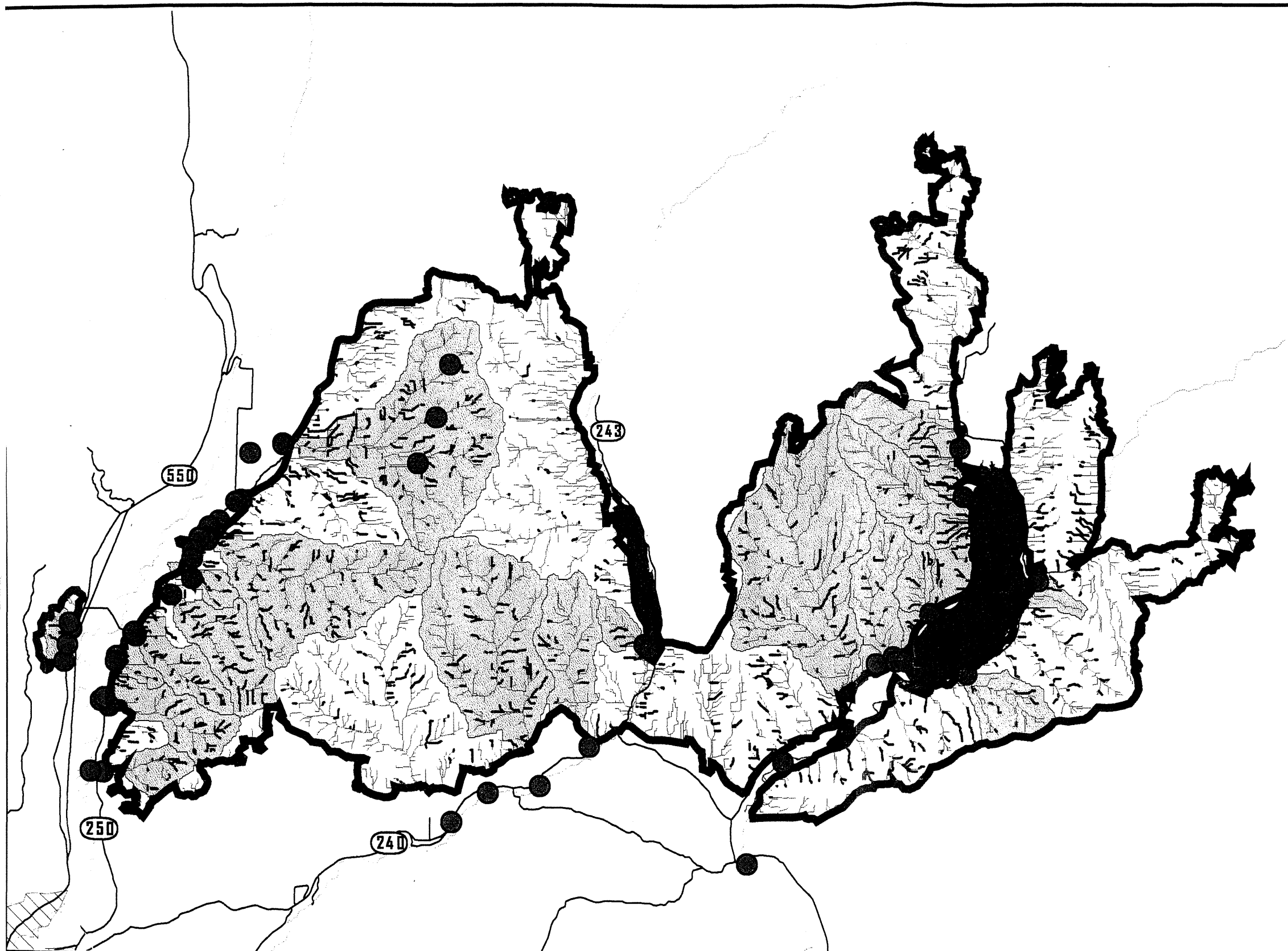
Locator Map San Juan National Forest



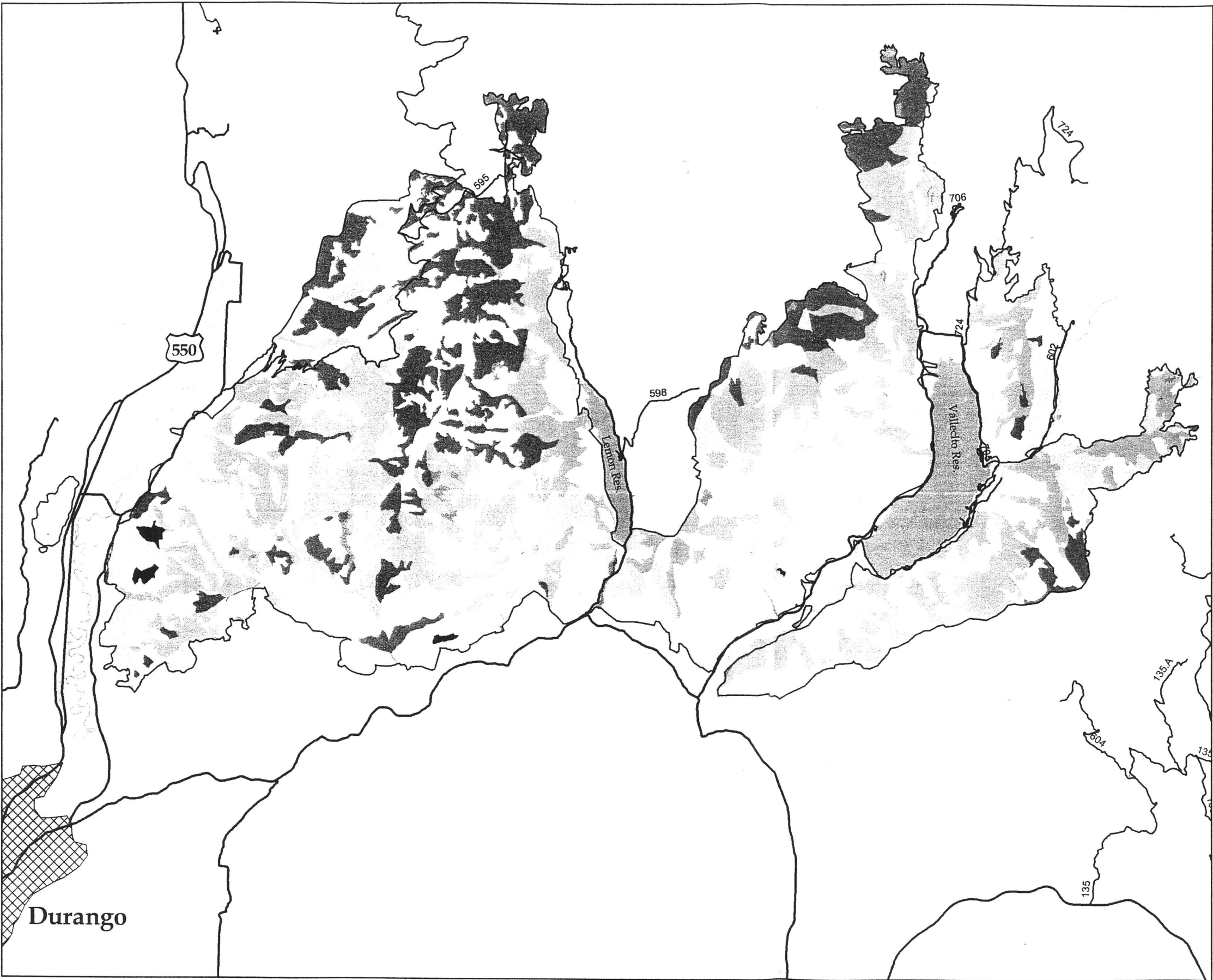
Missionary Ridge Complex BAER Team



USGS
science for a changing world



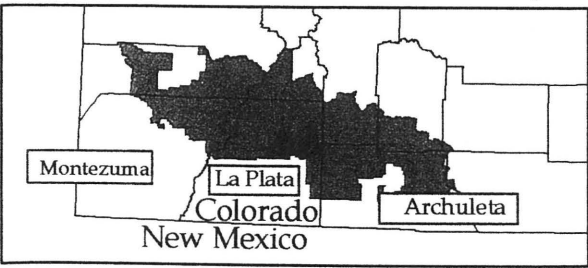
Missionary Ridge Complex Pre-Burn Vegetation



Legend

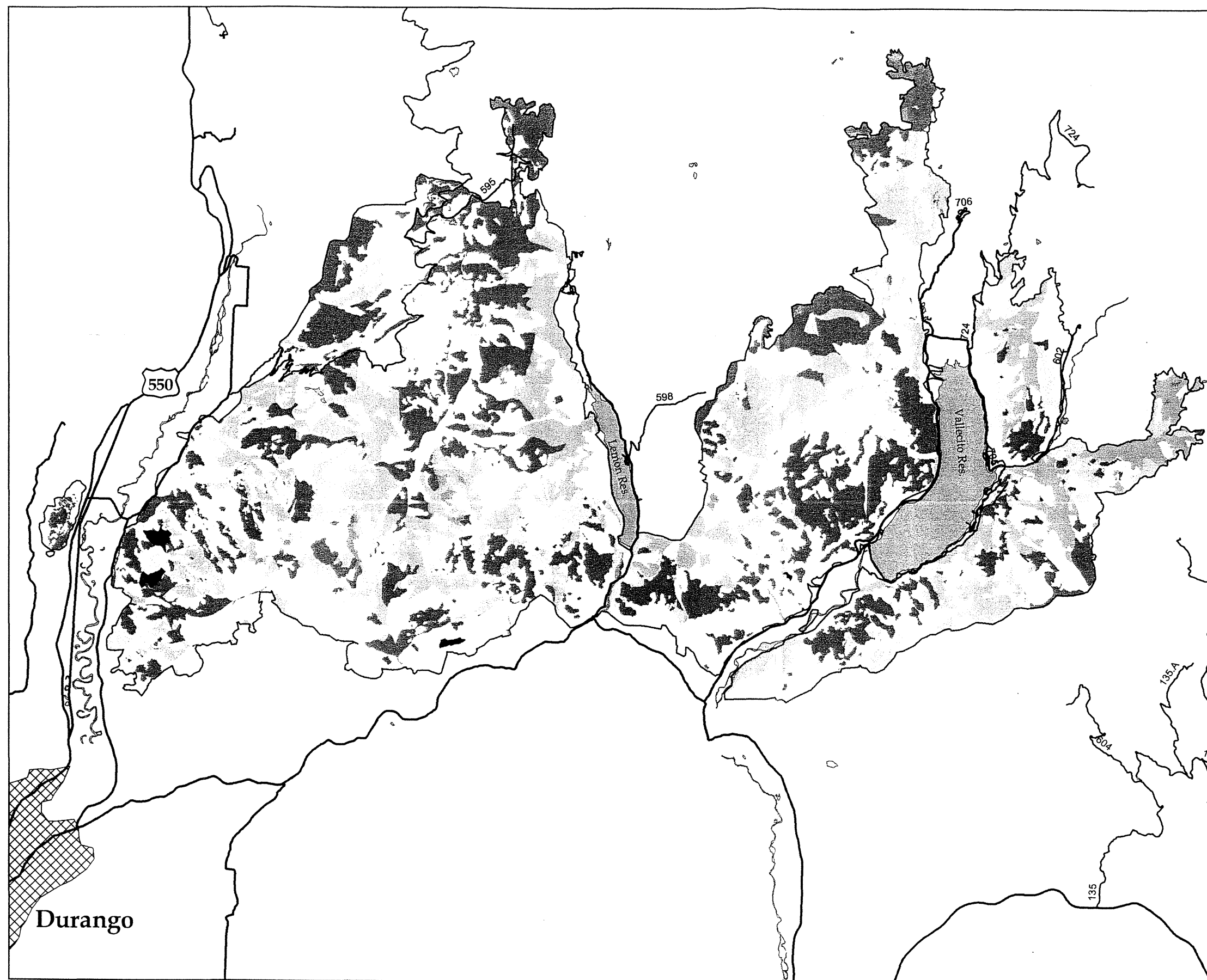
- Missionary Ridge and Valley Fire
- Forest Development Road
- Federal, State, or County Road
- Cities
- Alpine
- Rock / Soil
- Spruce / Fir
- Aspen
- Cool Moist Mixed Conifer
- Warm Dry Mixed Conifer
- Ponderosa Pine
- Mountain Shrubland
- Other Shrubs
- Sagebrush
- Mountain Grassland
- Pinyon / Juniper
- Riparian
- Water
- wshclip

Scale 0 0.5 1 2 Miles
1:126,720



Missionary Ridge Complex
Baer Team

Missionary Ridge Complex Predicted Post-Burn Vegetation

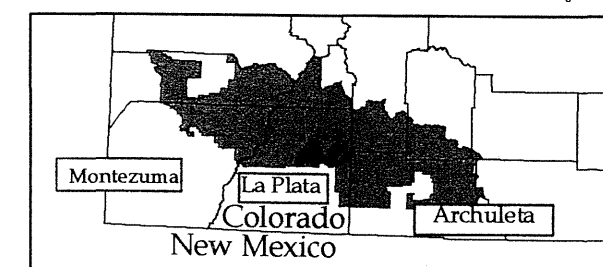


Legend

- Missionary Ridge and Valley Fire
- Forest Development Road
- Federal, State, or County Road
- Cities
- Water
- Alpine
- Rock / Soil
- Spruce / Fir
- Aspen
- Cool Moist Mixed Conifer
- Warm Dry Mixed Conifer
- Ponderosa Pine
- Mountain Shrubland
- Other Shrubs
- Sagebrush
- Mountain Grassland
- Pinyon / Juniper
- Riparian

Scale
1:126,720

0 0.5 1 2 Miles



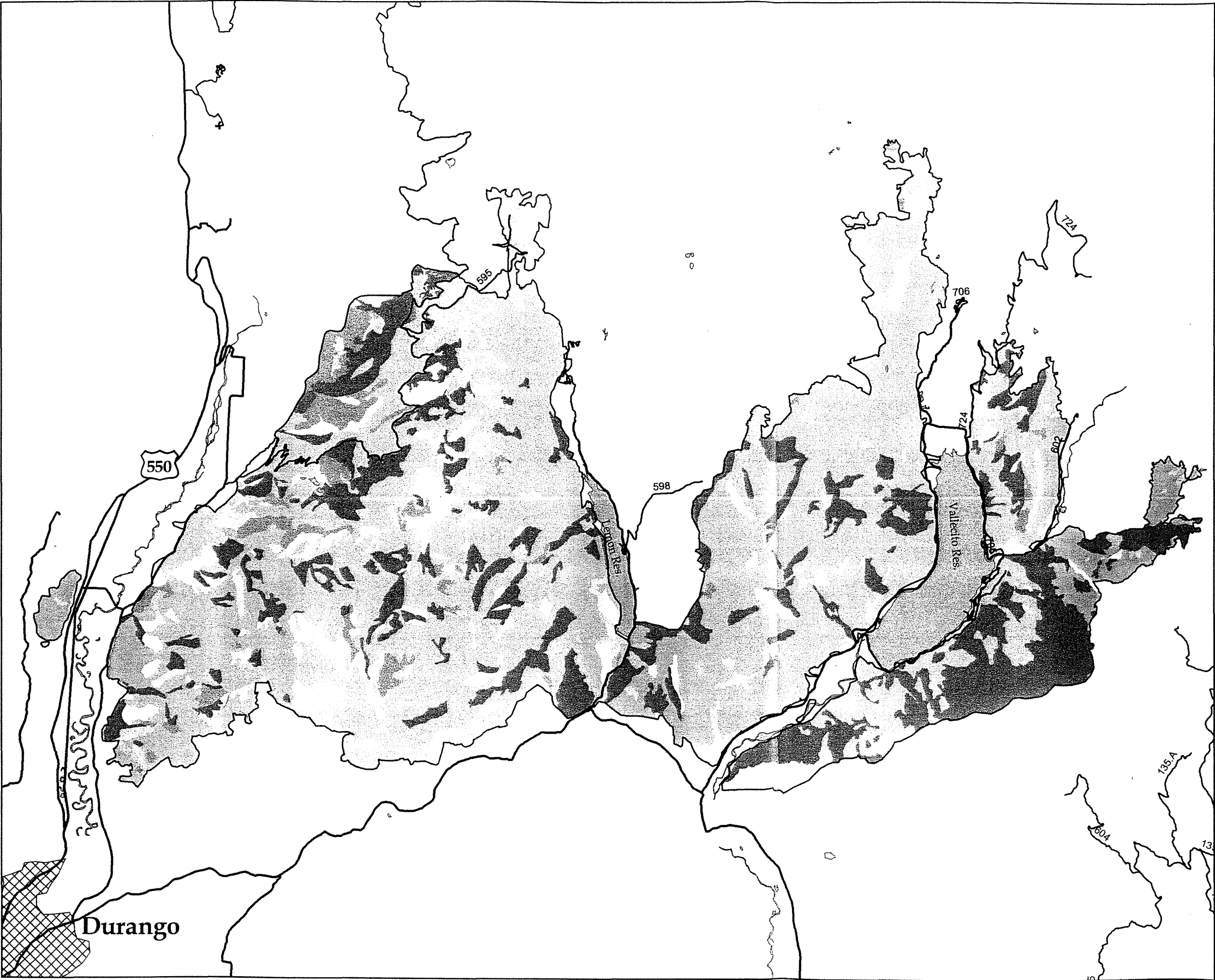
Missionary Ridge Complex
Baer Team



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Missionary Ridge Complex
Pre-Burn Wildlife Habitat
Structural Stages



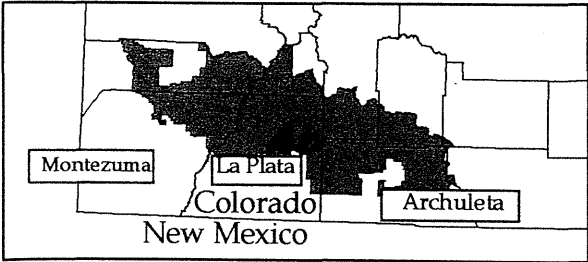
Legend

- Missionary Ridge and Valley Fire
- Forest Development Road
- Federal, State, or County Road
- Cities
- Water

Structural Stage

- 1 - Grass / Forb
- 2 - Shrub / Seedling
- 3a - Pole, 25-39% Crown Cover
- 3b - Pole, 40 - 69% Crown Cover
- 3c - Pole, 70% - 100% Crown Cover
- 4a - Large, 25 - 39% Crown Cover
- 4b - Large, 40 - 69% Crown Cover
- 4c - Large, 70 - 100% Crown Cover

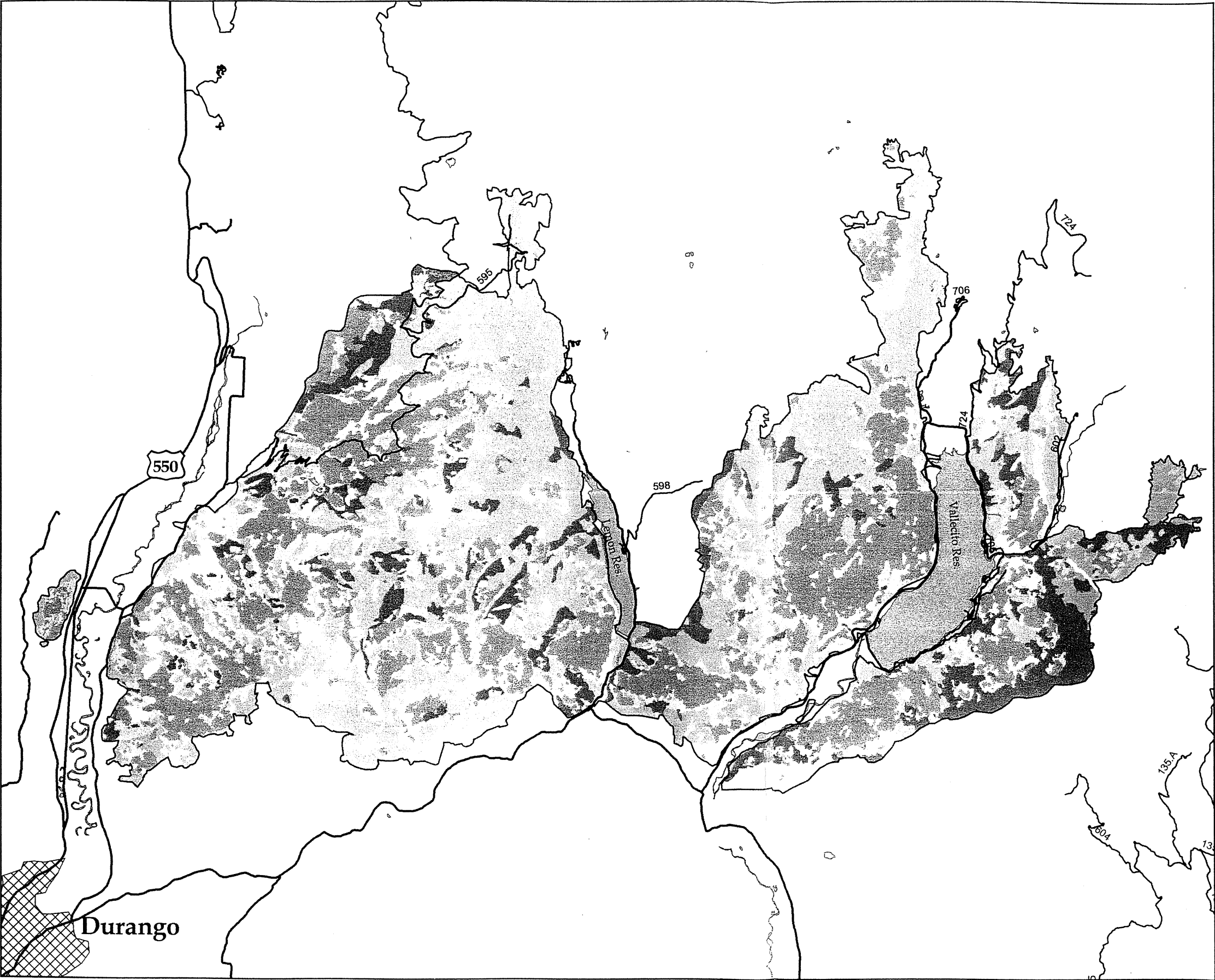
Scale 0 0.5 1 2 Miles
1:126,720



Missionary Ridge Complex
Baer Team



Missionary Ridge Complex
Post-Burn Wildlife Habitat
Structural Stages



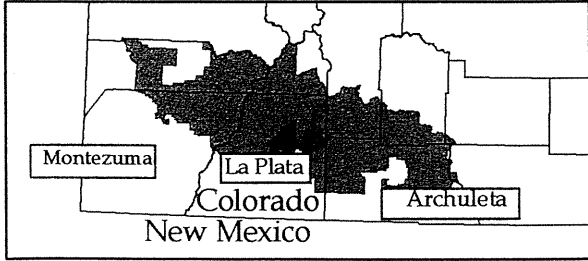
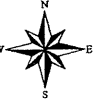
Legend

- Missionary Ridge and Valley Fire
- Forest Development Road
- Federal, State, or County Road
- Cities
- Water

Structural Stage

- 1 - Grass / Forb
- 2 - Shrub / Seedling
- 3a - Pole, 25-39% Crown Cover
- 3b - Pole, 40 - 69% Crown Cover
- 3c - Pole, 70% - 100% Crown Cover
- 4a - Large, 25 - 39% Crown Cover
- 4b - Large, 40 - 69% Crown Cover
- 4c - Large, 70 - 100% Crown Cover

Scale 0 0.5 1 2 Miles
1:126,720



Missionary Ridge Complex
Baer Team



Missionary Ridge Complex Seeding Areas

Legend

Seeding Area Mixes

■ Animas 5678 Acres

■ Florida 3276 Acres

■ Pine 6006 Acres

□ Missionary Ridge Complex Perimeter

— Roads

— Streams

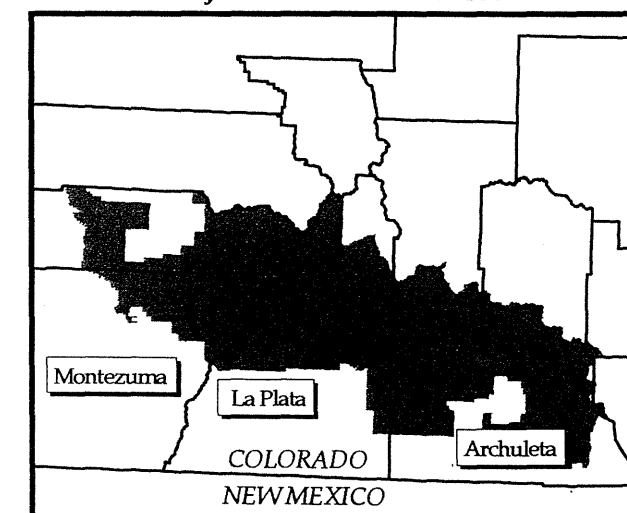
— Major Rivers

■ Lakes

Scale 1 0 1 2 Miles
1:126720



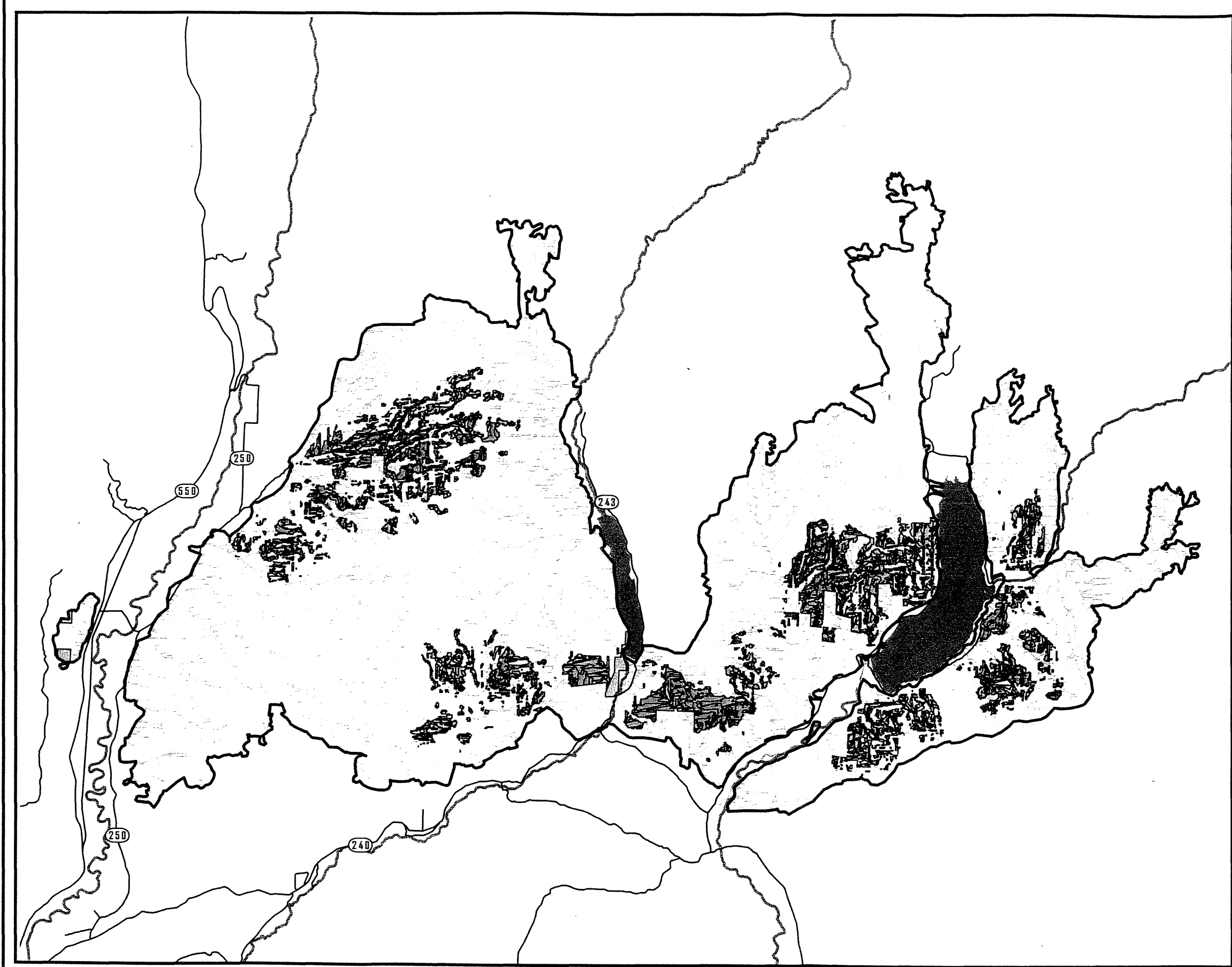
Locator Map San Juan National Forest



Missionary Ridge Complex BAER Team

Missionary Ridge Complex

Hillslope Treatments



Legend

Hillslope Treatments

- Log Erosion Barriers
- Straw Mulch

Treatment Priority

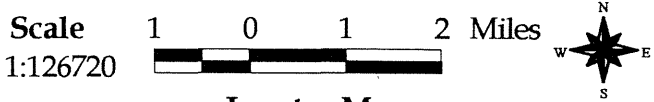
- Primary
- Secondary

Missionary Ridge Complex Perimeter

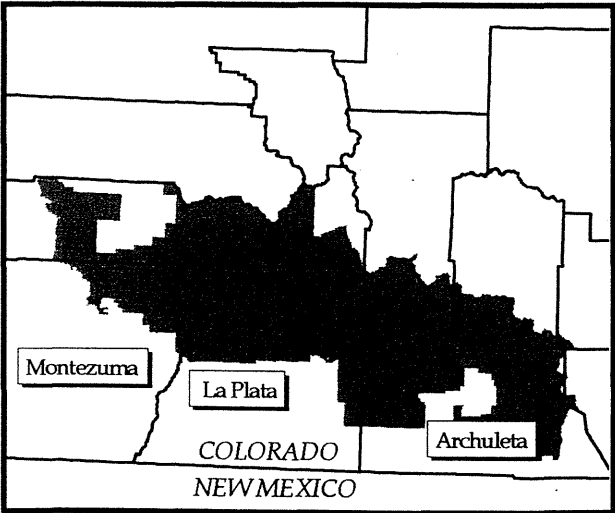
Roads

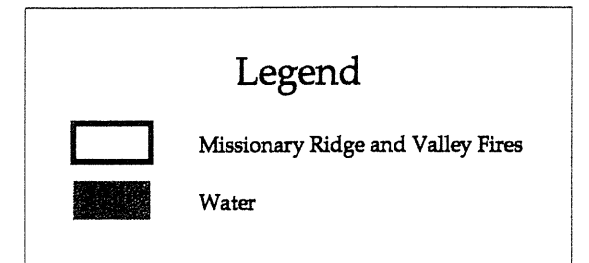
Streams

Lakes

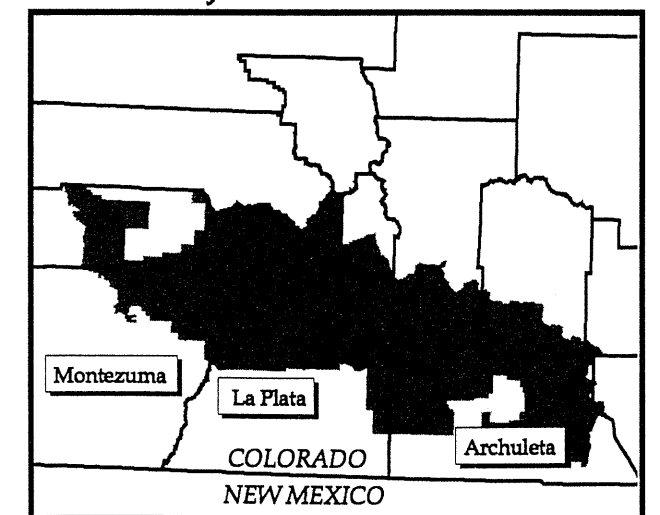


Locator Map
San Juan National Forest





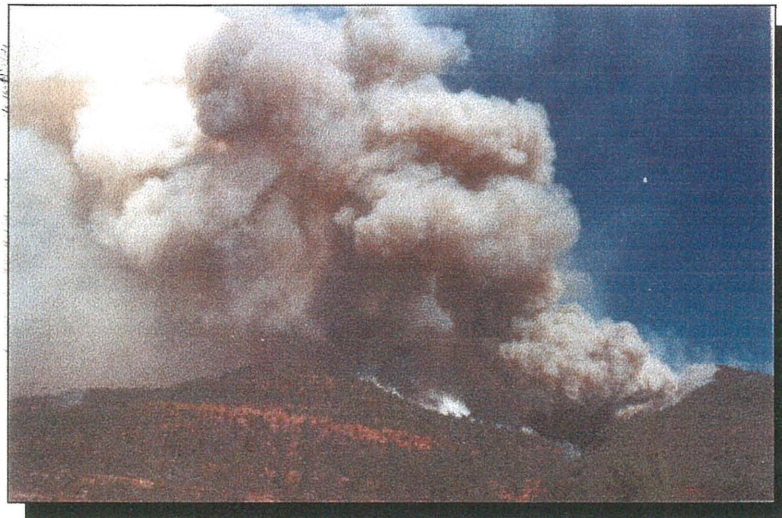
**Locator Map
San Juan National Forest**



Appendix IV. PHOTO DOCUMENTATION



Photo by T. Harris





Watershed Issues



Mud flow - Missionary Ridge Fire Area



Mud flow



BAER Team member measuring cross-section of stream channel



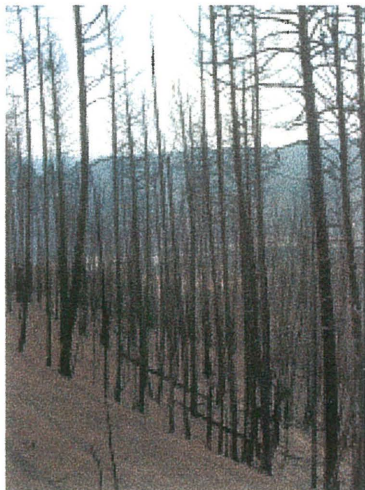
Post-Fire Potential Risks



Ash and sediment wash over County Road 250, July 8



Channel draining to Lemon Reservoir spillway



Coon Creek high severity burn



Debris in channel -- North Fork of Coon Creek



Example of moderate burn severity



Flood flow, July 8, Animas Valley
irrigation ditch



Flooding of Animas ditch



Rill development -- Coon Creek landslide



Values at risk, East Animas

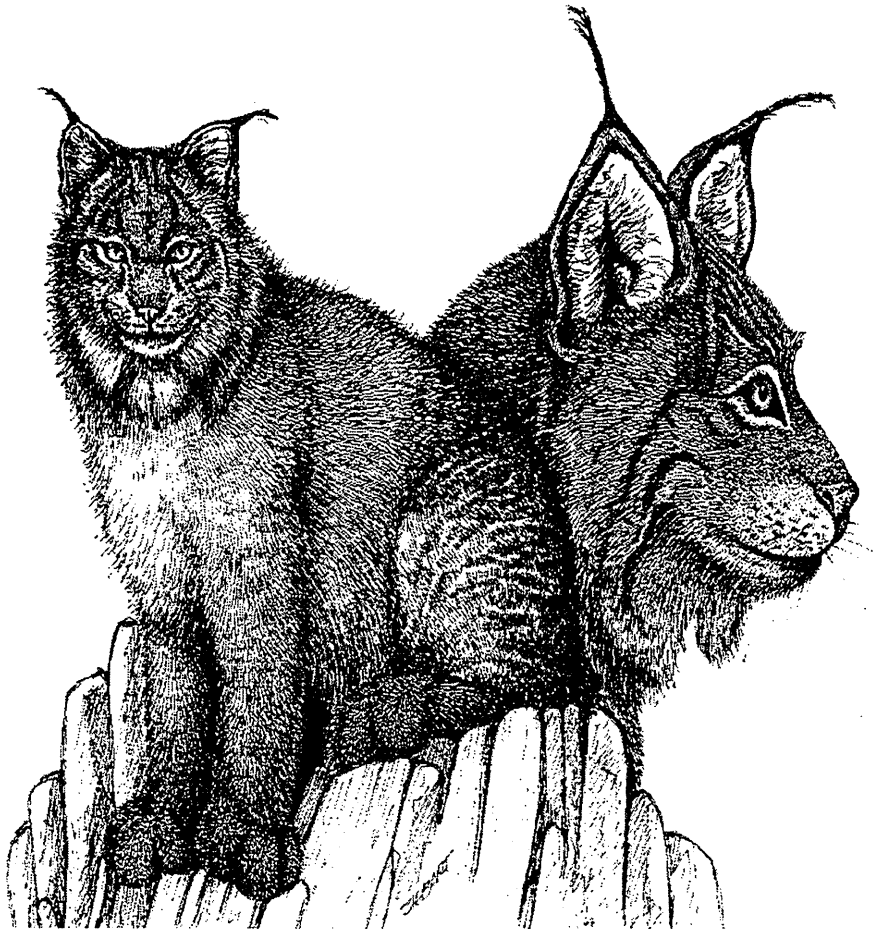


Area danger of flood conditions



West side of Vallecito Reservoir, high severity burn

Appendix V. SUPPORTING DOCUMENTS



Lynx
Carol Ziebart, U.S. Forest Service

Statement of Work and Operation Policies

U.S. Geological Survey Missionary Ridge Rain Intensity Gaging Network

Purpose

The Missionary Ridge area of the San Juan National Forest was severely damaged by fire. The network of rainfall intensity gages was established to provide rain intensity data to Federal, State, and local agencies charged with the responsibility to respond to flood and debris flow emergencies that result from intense rainfall events in the Missionary Ridge area. The area was severely damaged by wildfire.

This document details the responsibilities of the US Geological Survey (USGS) in regard to the operation and maintenance, data management, and products of this network. A separate Memorandum of Understanding document outlines each agencies responsibility in the maintenance and operational use of this network.

Operation and Maintenance

1. A data collection platform (DCP) instrument that logs and transmits rainfall intensity information and a tipping bucket rain gage will be installed at each site. A 80-100 amp-hour 12-volt DC deep-cycle battery recharged by a 20-watt solar panel will power the system. The information will be logged every fifteen minutes during routine operation and data transmitted every four hours. The DCP will be programmed to transmit randomly during storm events. A random transmission will occur when intensity exceeds 0.02 inches between the scheduled measurement intervals of one minute. The random transmissions are generated in the first four minutes and one random every five minutes for the next fifteen minutes.
2. Instrumentation and equipment are serviced routinely three times per thunderstorm season to verify operation. Additional repair visits are made as needed. Response time to restore site operation will be within a 24-hour window after notification or discovery providing that the site is accessible and that helicopter transportation is available if required.
3. The USGS will service, repair, and maintain all instrumentation, support equipment, and structures.
4. The USGS is responsible for all structure, support equipment, and instrumentation maintenance and repair costs but may negotiate emergency funding support if there is loss as a result of a catastrophic event.



5. Established U.S. Geological Survey protocols are used for all fieldwork, record computation, and data management.

Data Management

1. All data collected are stored and maintained in the USGS database: the National Water Information System.
2. Historic recorded data will be archived electronically. Hard copy supporting documentation will be archived at the Federal Records Center (FRC).

Products

1. Display of rainfall intensity information on the USGS real-time web page.
2. A rainfall intensity data set for each network site. Documentation of servicing and repair activities.
3. Informal meetings conducted as requested by the cooperator to summarize data and discuss program needs.
4. Current rainfall intensity data will be available to the cooperator and the public via the USGS web or the District office in Denver.
5. Historic rainfall intensity data will be available to the cooperator and the public from the USGS web or from the District office.
6. A cost may be charged to the public for records or documentation retrieved from the FRC.

Instrumentation, Support Equipment, and Shelter

All structures, instrumentation, and support equipment attached to the instrumentation remain the property of the US Forest Service. The USGS retains all other support equipment necessary to service the network.

Costs for the Proposed Missionary Ridge Twelve Site Rainfall Intensity Network

Collaboration

The US Forest Service (USFS) and the US Geological Survey (USGS).

Instrumentation and installation costs

Option 1:

Rent instrumentation from the USGS Hydrologic Instrumentation Facility to facilitate rapid initial deployment of the network. Purchase instrumentation to replace the rented equipment as soon as possible. Use the purchased instrumentation for the current network and as a stockpile of instrumentation for use at future burned areas.

Advantages

- Quick deployment that is not dependent on vendor supply.
- Purchasing equipment for the long-term eliminates the possibility that sufficient units might not be available for rent each season.
- Purchasing equipment creates a stockpile available for future use.

Disadvantages

- Capital investment in instrumentation.

12-site network with one spare set of instrumentation and equipment:

Rent instrumentation, two months	\$ 5,900
Purchase instrumentation,	\$125,500
Purchase support equipment, supplies	\$ 66,400
Installation	<u>\$ 33,300</u>
Total	\$231,100

Option 2:

Rent instrumentation each season of operation.

Advantages

- No capital investment in instrumentation.

Disadvantages

- Rental instrumentation may not be available in sufficient quantities because the inventory is depleted. There may be delays in shipment until the inventory is replenished. This period could be a week to several months.

12-site network with one spare set of instrumentation and equipment:

Rent instrumentation, three seasons	\$ 55,800
Purchase support equipment, supplies	\$ 66,400
Installation	<u>\$ 33,300</u>
Total	\$155,500



Operation and Maintenance costs

Refer to Statement of Work for detailed information. Network operation from June to November each year.

NOTE: These costs do not reflect funds required if the USGS must rent helicopters to service the network or wages that might be required to fulfill weekend maintenance standby duties by computer support and field maintenance personnel.

FY02 \$41,900

FY03 \$44,800

FY04 \$47,500

Precipitation Values (in inches) Used for Flow Modeling

Recurrence Interval	Storm Duration		
	30 minutes	1 hour	6 hours
1 Year	.35	.50	NA
2 Years	.50	.67	1.8
5 Years	.70	.90	2.2
10 Years	1.00	1.1	2.6
25 Years	1.1	1.3	3.0
50 Years	1.3	1.5	3.4
100 Years	1.4	1.7	3.8